ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

OCTOBER 1953

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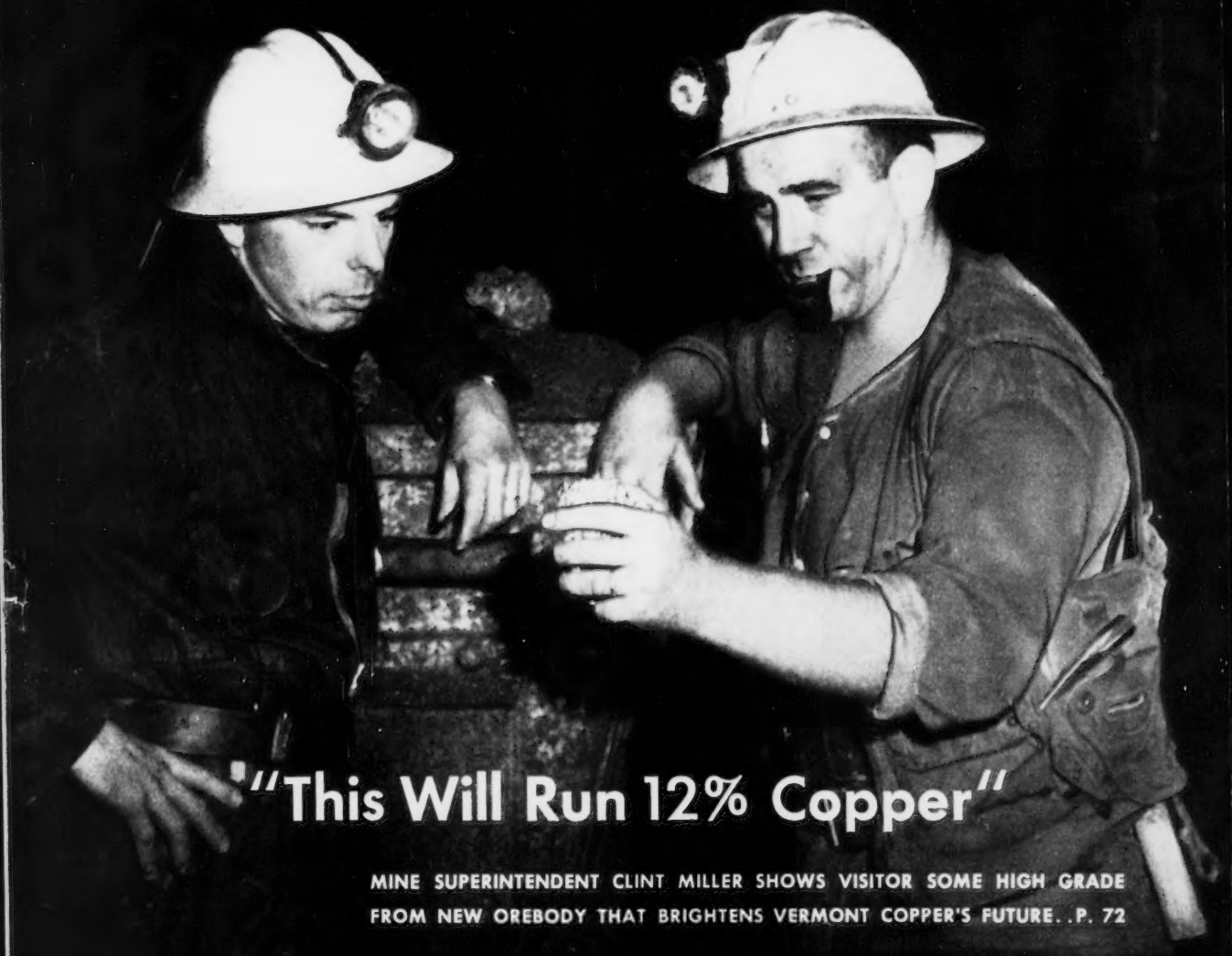
FOR ALL RED FEATHER SERVICES



"This Will Run 12% Copper"

MINE SUPERINTENDENT CLINT MILLER SHOWS VISITOR SOME HIGH GRADE FROM NEW OREBODY THAT BRIGHTENS VERMONT COPPER'S FUTURE. . P. 72

Plus

FLAT DRILL STEEL—How it's cutting costs in Scandinavian mines. . p. 86

FLASH SMELTING—Better matte, lower costs, no extraneous fuel. . p. 76

AFRICAN GOLD—An expert reports on what the producers face. . p. 81

Hydroseals help J & L

win the big battle against cost

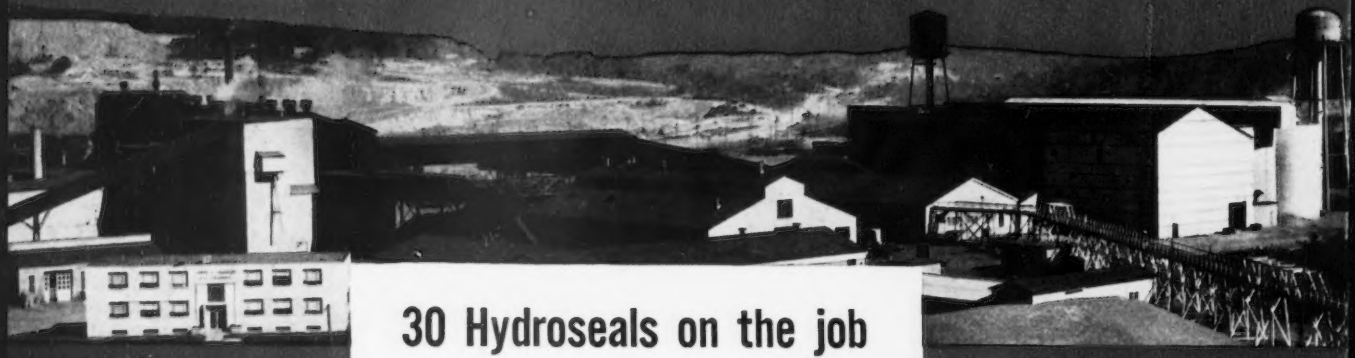
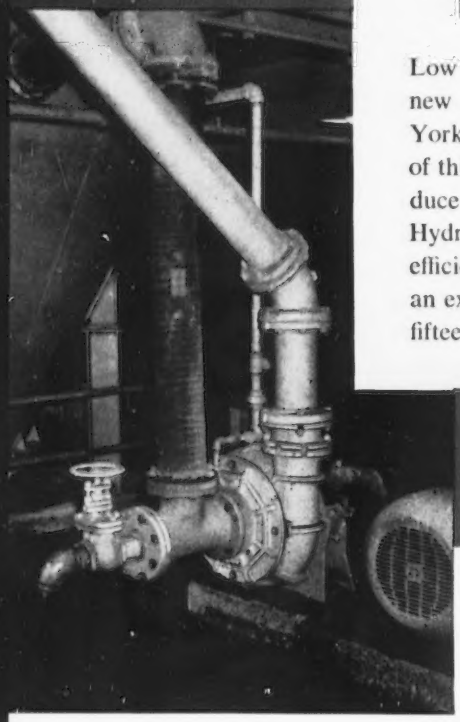


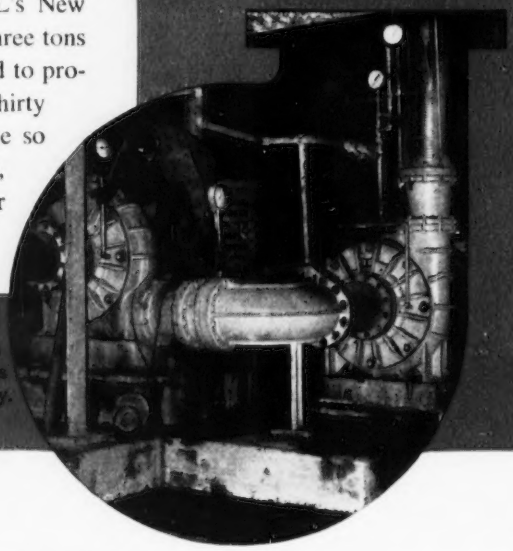
Photo at right courtesy of Mining World

New York Ore Division, Jones & Laughlin Steel Corp., at Star Lake, N. Y. Martite ore concentration plant is on right, in cubical building.

30 Hydroseals on the job
15 more on the way

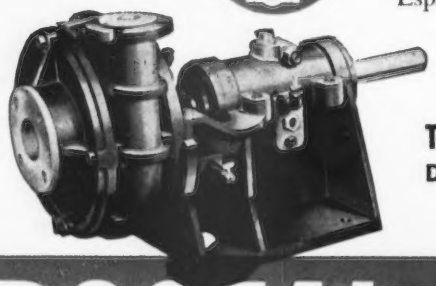
Low cost is a big operational factor in the new martite recovery plant of J&L's New York Ore Division at Star Lake—three tons of this hard ore must be beneficiated to produce one ton of sinter! Because thirty Hydroseal Pumps are proving to be so efficient and economical on this job, an expansion program now calls for fifteen more of them.





Two 12-inch Hydroseals in series pump 1800 tons of martite tailings through a mile of pipe every day.

Hydroseal delivering minus-14-mesh martite ore to the spirals.

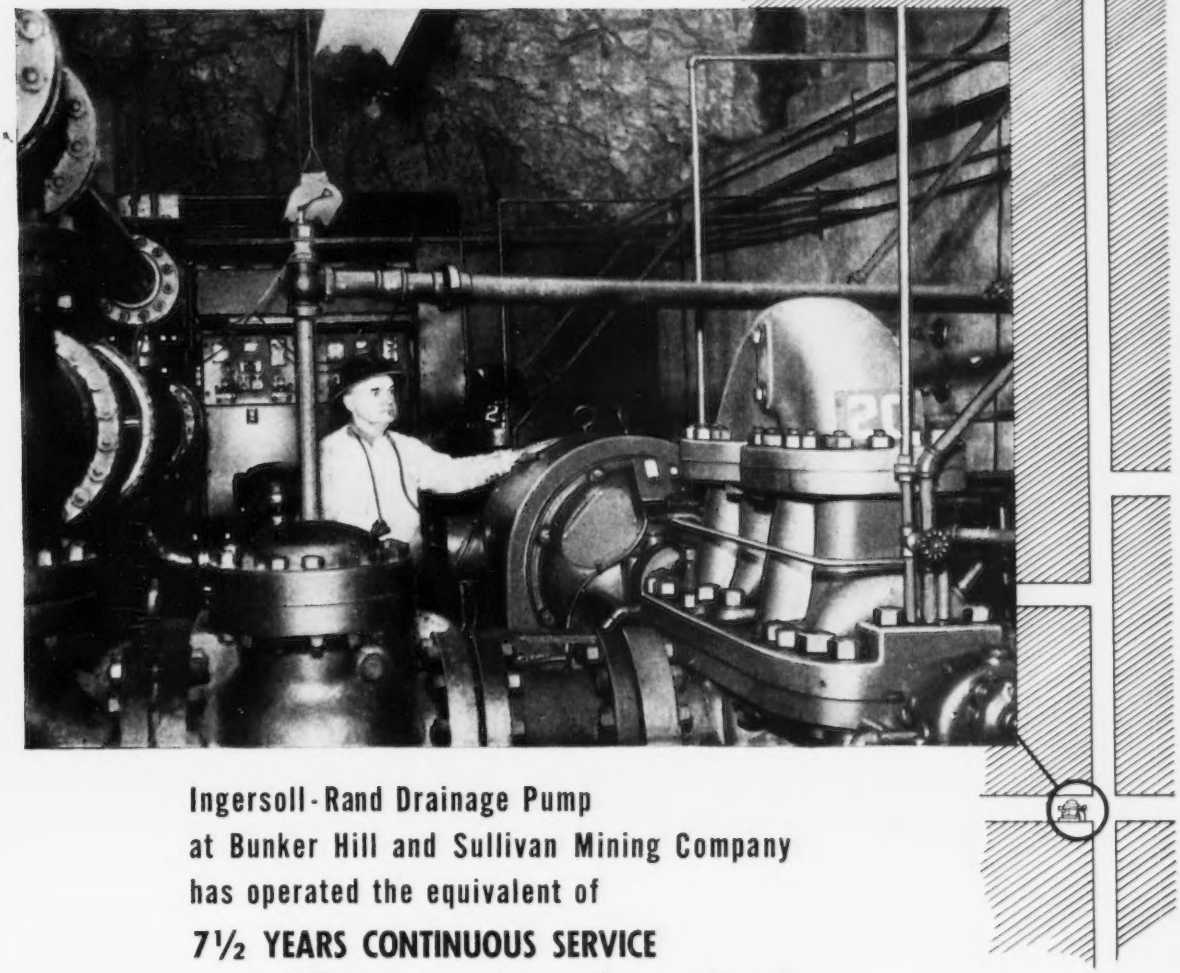


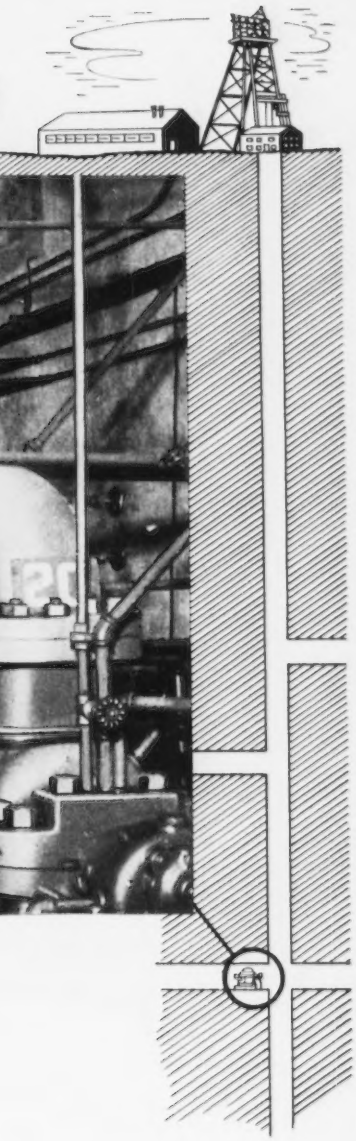
It is significant to you that Hydroseals were selected for the tough pumping at Star Lake. Especially if your operation demands economy as well as efficiency, it will pay you to query us about Hydroseals. Write today.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

67,420 HOURS at 1600 feet down





Ingersoll-Rand Drainage Pump
at Bunker Hill and Sullivan Mining Company
has operated the equivalent of

7½ YEARS CONTINUOUS SERVICE

... without opening the casing!

The Ingersoll-Rand pump shown above was installed in 1943, on No. 17 level of the Bunker Hill and Sullivan Mining Company, Kellogg, Idaho. Since then, this six-stage, Class RTS unit has been pumping 820 gpm of drainage water at 1750 ft. head for a total of 67,420 hours — and some 3 billion gallons. The only maintenance so far has been periodic repacking. And the casing has never been opened.

Successful performance like this stems from Ingersoll-Rand's years of experience in the design, construction and application of mine pumps for both centralized and de-centralized drainage systems. Through this experience, I-R engineers can select the materials that will give long pump service, whatever your water conditions.

If you have a pumping problem, why not talk it over with your I-R representative. He's had lots of specialized experience and will be glad to help you.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 959-10

COMPRESSORS • GAS & DIESEL ENGINES • ROCK DRILLS • PUMPS • TURBO-BLOWERS • AIR & ELECTRIC TOOLS

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LETTERS TO THE EDITOR

Let's have your comments too! Your reactions to articles and features appearing in E&MJ will be welcomed. Address your letters to The Editor, Engineering and Mining Journal, 330 West 42nd Street, New York 36, N. Y.

Stone Cutting

SIR:

In the August issue of *E&MJ*, on page 131, there was an article regarding a new (Soviet) machine to cut dimension stone. Will you please put us in contact with the company which manufactures or sells this equipment?

F. B. PRESCOTT

Western Minerals Development Co.
Tacoma 3, Wash.

Ed.: Soviet authorities in New York suggest contacting the Commerce Department, Moscow, or the Commercial Attache, USSR Embassy, Washington.

Niobium vs. Columbium

Sir:

I have read with interest and some sympathy the adverse comments in Mr. G. P. Lutjen's column "Behind the By-Lines" concerning the substitution of the name "niobium" for "columbium." It is always distasteful to find that in the interests of standardization of terminology the appropriate authorities have accepted a word or phrase that differs from that in use in one's own area, country, or field of specialization.

In this instance may I point out that there is no noticeable "mad urge in geologists to make every one else change steps" and that this applies particularly to the Geological Survey. However, we recognize that the names of the chemical elements are primarily the responsibility of the chemists.

After 75 years of controversy on this name, Americans using columbium and Europeans niobium, it was decided at a meeting of the Inter-

(Continued on page 102)

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

One belt does the work of 3— hauls 900 tons an hour uphill

GETTING iron ore out of a deep pit like this used to call for a series of three or more conveyor belts. No one belt was strong enough, flexible enough to haul that far, that steep.

Then B. F. Goodrich developed steel cord construction. In this exclusive belt design, individual steel cords run lengthwise, each completely surrounded by rubber. These parallel cords give tremendous strength, yet are flexible so that troughing is natural, belt keeps centered on idlers, spillage is held to a minimum.

With steel cord construction, a single-flight conveyor now does the job of three or four belts on high lift, long distance installations. Money is saved, handling is faster because the steel cord belt eliminates the transfer point necessary with a conveyor system built in several stages with ordinary belts.

Extraordinary records made by the B. F. Goodrich belt on other "impossible" jobs convinced this mining company it would stand the strain on this one. The B. F. Goodrich steel cord belt was installed, and has been at work ever since—summer and winter—hauling 900 tons an hour up the steep incline.

If you need a conveyor belt that must take severe impact on loading, and haul heavy loads up steep inclines, let your local BFG distributor show you how a B. F. Goodrich steel cord belt can do the job more efficiently and at lower cost than a system built in several flights. Or send the coupon below for more information.

The B. F. Goodrich Company
Dept. M-106, Akron 18, Ohio

Without obligation, please send information on:

☐ steel cord belts.

☐ other products (name type) _____

☐ Have a BFG distributor see me.

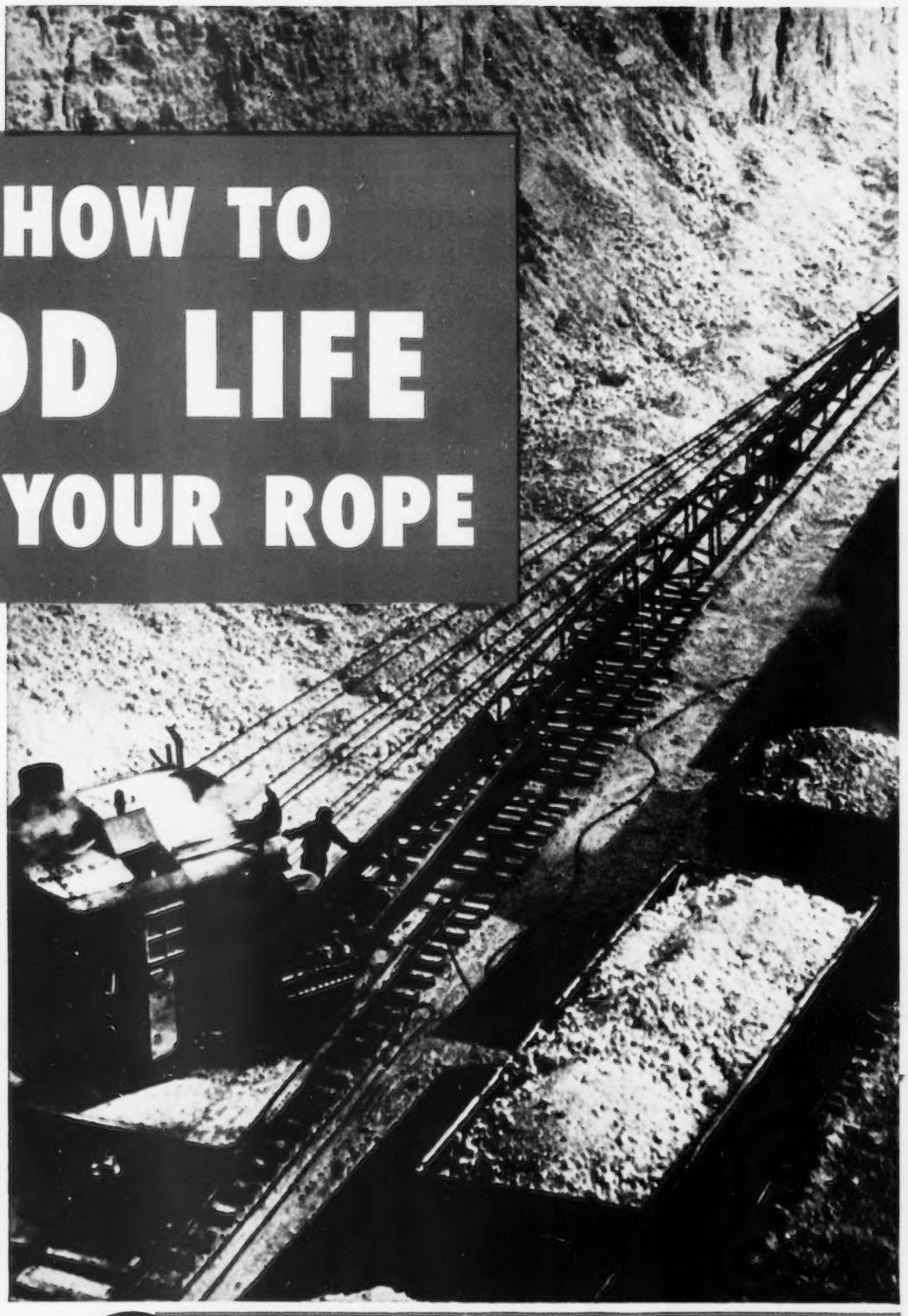
Name _____

Company _____

Address _____

B.F.Goodrich
INDUSTRIAL PRODUCTS DIVISION

HOW TO ADD LIFE TO YOUR ROPE



TEXACO

TEXACO

FIRST on the list of good maintenance practices is effective lubrication. Use *Texaco Crater* — the *penetrating* lubricant that keeps rope strong longer, cuts maintenance costs.

Texaco Crater goes right to the heart of your rope, surrounding the core with its preservative film. At the same time, it coats the strands thoroughly with a tough, clinging lubricant that affords long-lasting protection against wear and rust.

For open gears, too, *Texaco Crater* is ideal. It clings to the gear teeth, does not channel or throw off, stands up under shocks and heavy loads. You get quieter operation, longer gear life.

For greater convenience in both applications, use *Texaco Crater X Fluid*. It *goes* on as a liquid *(without heating!)* and *stays* on even in coldest weather.

In mine car wheels, use *Texaco Olympian Grease* — available in three consistencies to meet the requirements of plain, cavity hub or anti-friction bearings. *Texaco Olympian Grease* assures easier starts in winter as in summer, reduces maintenance costs.

Let a Texaco Lubrication Engineer help you add life to all your equipment. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

FOR OVER 20 YEARS, MORE COPPER ORE HAS BEEN MINED IN THE U.S. WITH TEXACO-LUBRICATED EQUIPMENT THAN WITH ANY OTHER

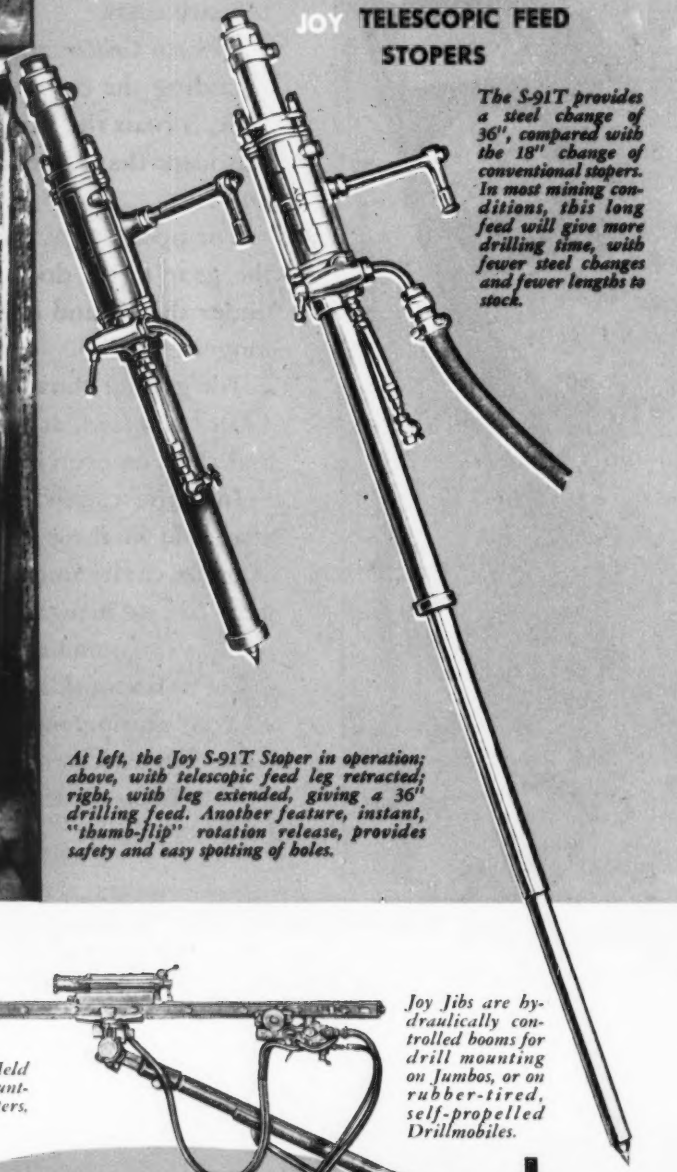
Lubricants and Fuels

FOR THE MINING INDUSTRY

You get * DOUBLE DUTY

JOY TELESCOPIC FEED STOPERS

The S-91T provides a steel change of 36", compared with the 18" change of conventional stopers. In most mining conditions, this long feed will give more drilling time, with fewer steel changes and fewer lengths to stock.



At left, the Joy S-91T Stoper in operation; above, with telescopic feed leg retracted; right, with leg extended, giving a 36" drilling feed. Another feature, instant, "thumb-flip" rotation release, provides safety and easy spotting of holes.

JOY
HAND-HELD DRILLS

A complete line of well-balanced, compact drills, ranging from 27 to 67 lbs. in weight.

The L-57 and L-67 Joy Hand-Held Drills are also available with mounting brackets for use as light drifters, or for wagon drill mounting.

The L-47 Drill is also available with the air-operated feed leg that combines all the best features . . . the new

JOY
AIR LEG

Joy Jibs are hydraulically controlled booms for drill mounting on Jumbos, or on rubber-tired, self-propelled Drillmobiles.

JOY HYDRO DRILL JIB

Air-hydraulic control of all jib movements eliminates heavy lifting, and permits more accurate hole spotting for more efficient use of powder and controlled breakage.

SINCE 1851—OVER 100 YEARS OF ENGINEERING LEADERSHIP

with JOY DUAL-VALVE SILVER STREAK DRILLS

Maximum Footage–Maximum Economy

In tunnels, crosscuts, drifts, or stopes, Joy *Silver Streak* Rock Drills with the DUAL VALVE will do your drilling job faster, and use less air with lower maintenance. Here's why—

(1) The exclusive DUAL VALVE, a feature of all Joy rock drills, makes air do more work. By admitting the correct amount of air behind the piston and excluding air ahead of it during the drilling stroke, maximum force is exerted on the drill steel. There's no cushion of air ahead of the piston to reduce the force of the blow. Then the rear section of the Dual Valve meters the correct amount of air ahead of the piston to force it back with a "snappy" rotating action. This adds up to more power-packed strokes per minute, for faster drilling with less air.

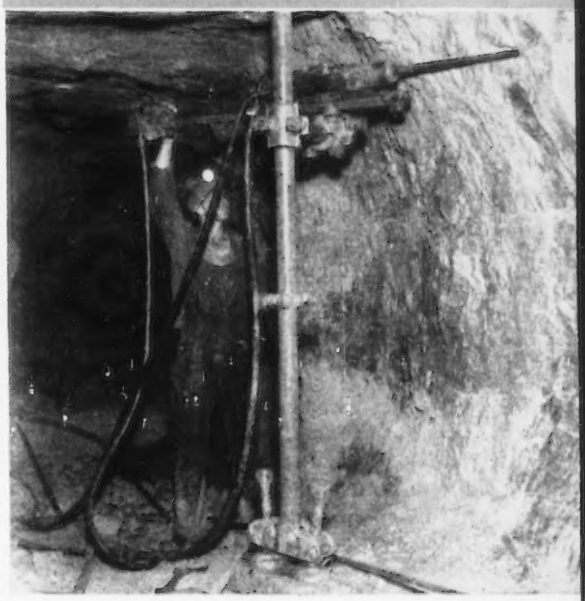
(2) The silver-like cadmium plating on Joy *Silver Streak* Rock Drills aids lubrication while running-in, protects parts from rust while in stock, and keeps maintenance costs at a minimum.

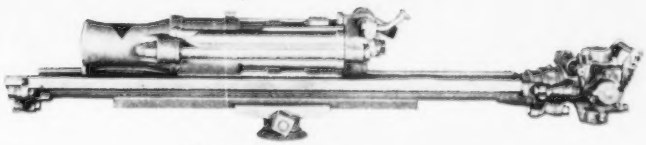
The Joy line is complete. There's a *Silver Streak* rock drill for every rock breaking need. Shown here are drifters, stopers, hand-held drills, Hydro Drill Jibs. To complete the line, there are wagon drills; the QB-20 for line drilling and dimension stone quarries; rubber-tired, self-propelled Drillmobiles; and specially mounted drills for special needs.

● *Let our Field Men work with you.*

JOY DUAL VALVE

"Makes Air do More Work"





JOY **DRIFTERS**

For column mounting, as at right, or for use on mobile jumbo units, Joy Drifters are built in three sizes—all with fast, powerful Dual Valve action. Efficient Pistonmotor Feed, with only two moving parts, provides strong, steady advancement and retraction. One-piece locking chuck increases bearing area and reduces wear on lock ring and chuck bushing.

Consult a Joy Engineer

W&D 3

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

ALLIS-CHALMERS

GRINDING MILLS

SPIRAL LINERS make grinding MORE PROFITABLE

INCREASED CIRCULATING LOAD
. . . LESS OVERGRINDING . . .
Material is kept on the move. Large balls do not overgrind fine particles needlessly. Percentage of circulating load has been *tripled* on several mills equipped with spiral liners!

EFFECTIVE BALL SEGREGATION
Large balls at feed end break large particles of incoming feed. Small balls concentrate at discharge end where they utilize greater ball surface for grinding smaller particles.

SIMPLIFIED FEEDING
Ball charge does not fight incoming feed. Motion imparted to balls and material by spiral liners results in a low level of balls at feed end and a higher level at discharge end.

INCREASED CAPACITY
More material can be put through mill in a given time. Retention time of material in the mill is reduced. Power cost is less — no power is wasted on overgrinding . . . ball segregation increases efficiency.

For application of spiral liners to your grinding mill, call the Allis-Chalmers representative in your area, or write Allis-Chalmers, Milwaukee 1, Wis.
A-4155

ALLIS-

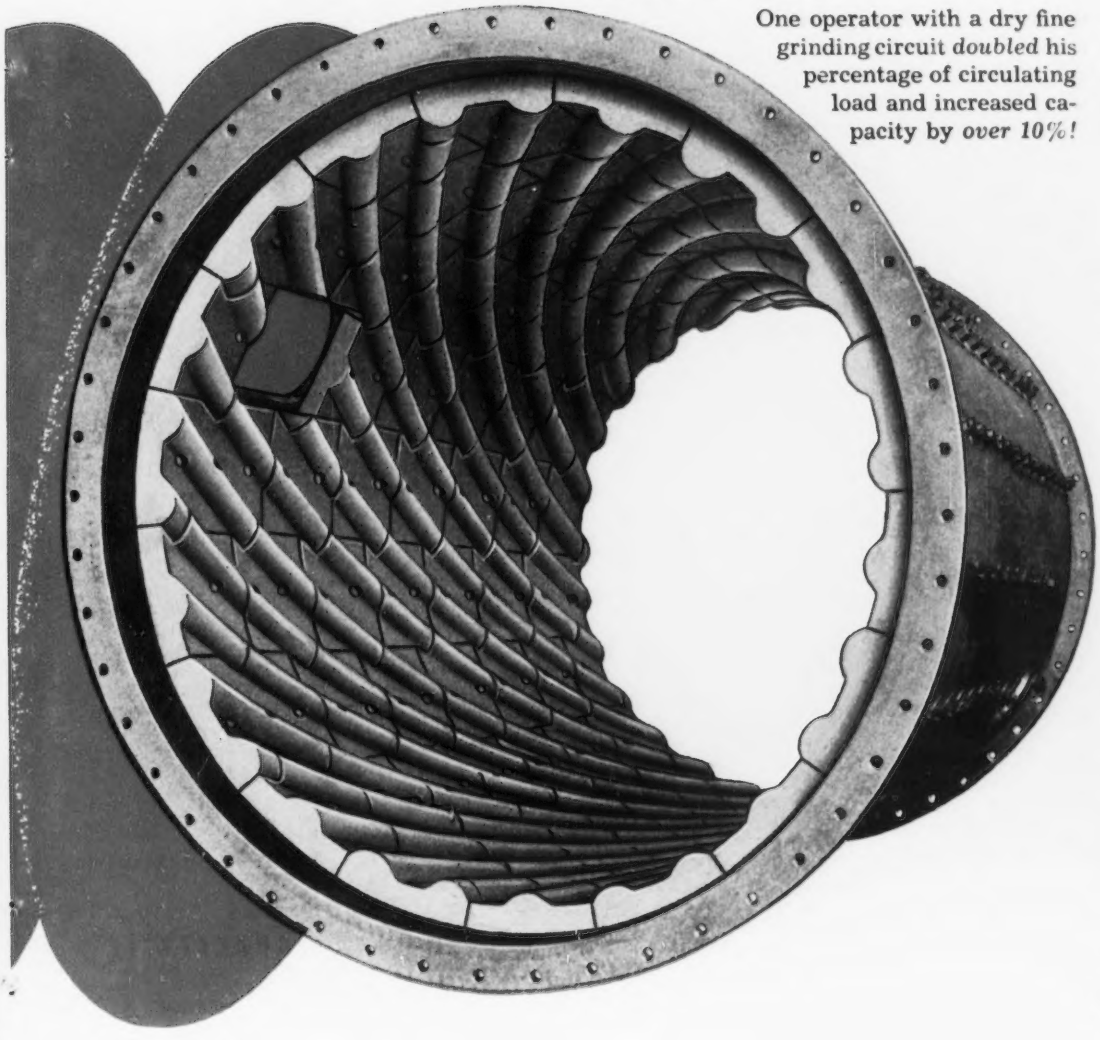
MILWAUKEE 1,

HERE ARE USER EXPERIENCES . . .

One operator with mills in a coarse wet grinding circuit *tripled* his percentage of circulating load with spiral liners.

Another wet grinding mill operator *tripled* circulating load and increased capacity by nearly 10%! Plans at this plant call for spiral liners for all ball mills.

One operator with a dry fine grinding circuit *doubled* his percentage of circulating load and increased capacity by *over 10%!*



CHALMERS

WISCONSIN

A-C ALLIS-CHALMERS

MEASURE OUTPUT by "KOEHRING WORK CAPACITY"

With Koehring excavators and cranes you gain an important production advantage in extra work capacity. There are some very simple ways to check this. Take lifting capacities, for instance. The machine with the heaviest lift capacity not only picks up larger crane loads — it also has more stability and power to increase shovel, dragline and clamshell output. Be sure to check lift ratings, and other clear-cut measurements of "KOEHRING WORK CAPACITY" before you buy any excavator or crane. Your Koehring distributor has important figures to show you. See him soon.

K331

lift capacities up to 79½ TONS . . . ½ to 2½ YARDS dipper capacities

BIG-PRODUCTION TEAM — Loading out big-chunk rock, this Koehring 1½-yard shovel is teamed up with Koehring 6-yard Dumpters.® Fast-spotting Dumpters move in close, keep shovel swing short. Square 8 x 8-ft. body permits loading over side or end. No-turn shuttle hauling and instant gravity-dump speed haul cycles.

KOEHRING Company

MILWAUKEE 16, WISCONSIN

Subsidiaries: Parsons • Kwik-Mix • Johnson

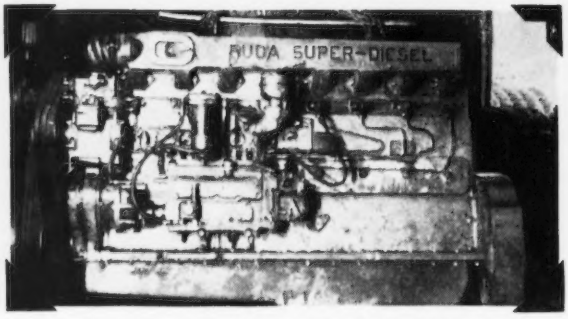
THE ENGINEER'S REPORT

DATA

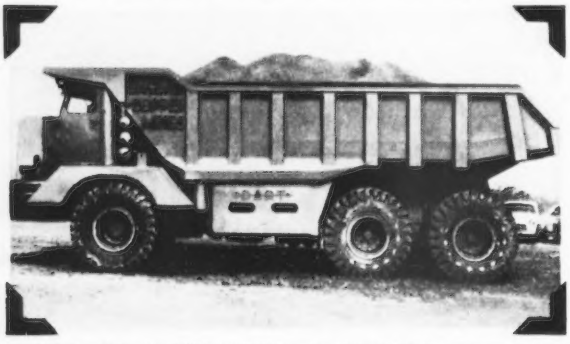
LUBRICANT	RPM Delo Oils
UNITS	21 Buda diesel engines
OPERATION	Hauling ore
CONDITIONS	Heavy duty — 8-15% grades
PERIOD	6 years
FIRM	Bagdad Copper Corp., Bagdad, Arizona

No stuck rings in 21 engines in 6 years hauling ore!

HAULING 22-TON LOADS up 8 to 15% grades out of the Bagdad Copper Corp. open-pit mine, 21 Buda diesels have had no stuck rings, no clogged ring grooves since using RPM DELO Special Lubricating Oil for

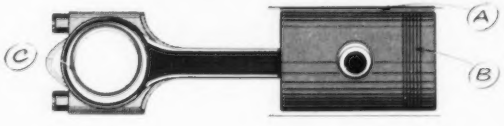


the last 6 years. Engines operate 2 shifts a day, 6 days a week in heavy abrasive dust. Torn down after 7000 hours, all parts in the engine above were exceptionally clean and all bearings were good.



BIGGEST OFF-HIGHWAY TRUCK IN THE WORLD (above) was recently built for Bagdad Copper Corp. It weighs 96,000 pounds, hauls 75 tons. RPM DELO Special Lubricating Oil was also selected for its two 350 H.P. supercharged Buda diesels because of the excellent service Bagdad has had from this oil.

How RPM DELO Oils keep engines clean and prevent wear



A. Contain special additives that provide metal-adhesion qualities...keep oil on parts whether they are hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean, helps prevent scuffing.

C. Special compounds stop corrosion of any bearing metal, and oil foaming in both wet and dry sump engines.

There is an RPM DELO Oil to meet every heavy-duty engine operating condition. FREE BOOKLET on the RPM DELO Oils gives you complete information. Write or ask for it today.

RPM DELO LUBRICATING OILS

STANDARD TECHNICAL SERVICE checked this product performance. For expert help on lubrication or fuel problems, call your Standard Fuel and Lubricant Engineer or Representative; or write Standard Oil Company of California, 225 Bush St., San Francisco.

TRADEMARKS "RPM DELO" REG. U.S. PAT. OFF.

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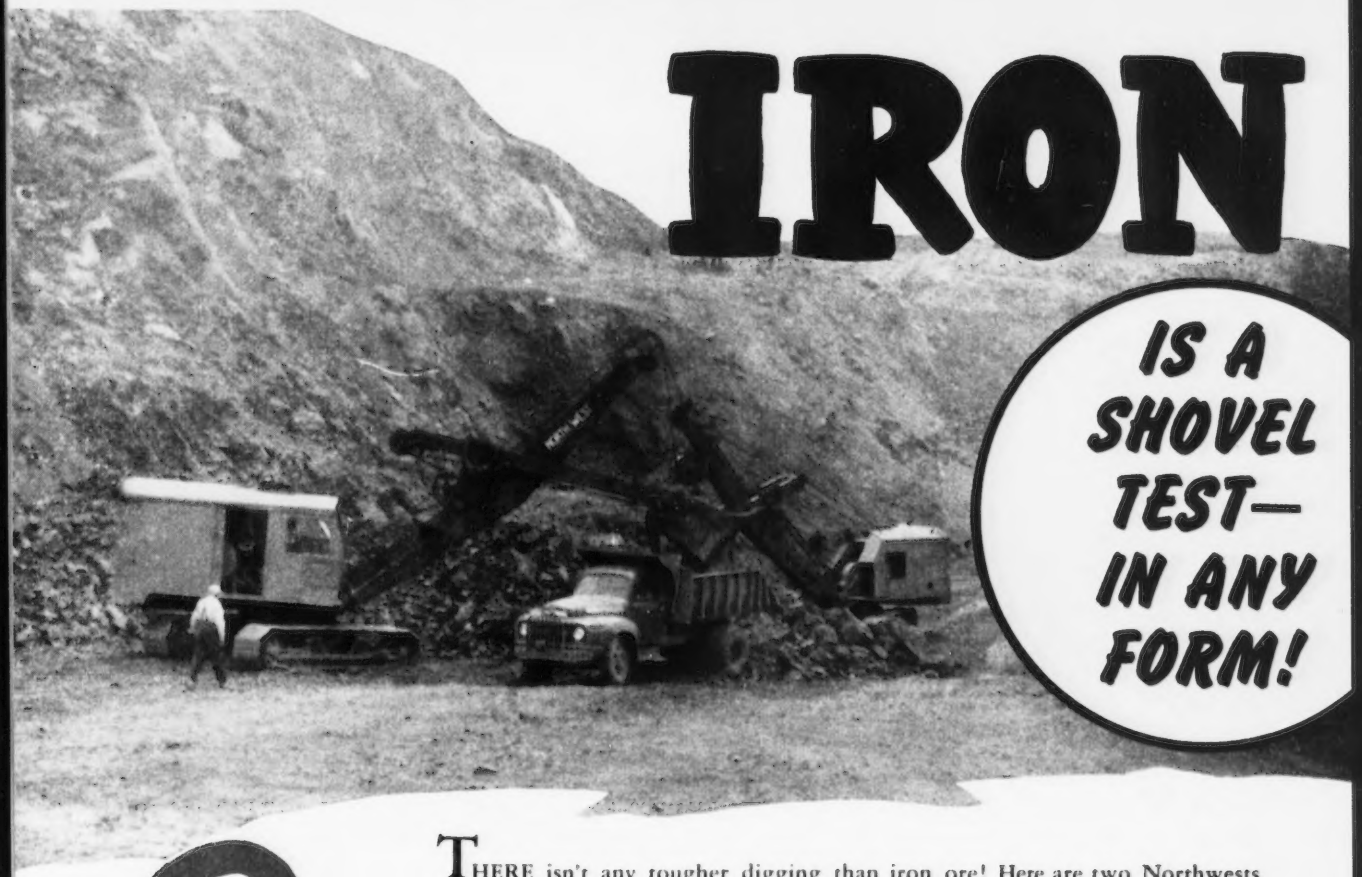
THE CALIFORNIA OIL COMPANY, Barber, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado



IRON

IS A SHOVEL TEST— IN ANY FORM!

2 MORE NORTHWESTS for the DODGE MINE

THERE isn't any tougher digging than iron ore! Here are two Northwests near Lovelock, Nevada, in the pits of the Dodge Iron Mine. These machines are repeat orders—two of sixteen repeat orders, in fact.

Northwests are hard rock shovels! This has been proved wherever iron is dug —on the Range, at Steep Rock, in the pits of Sheffield Steel, at Republic's pits at Lyon Mt., New York, at the pits of National Lead Co., Tahawus, New York, and many other places.

Northwest brings you advantages that make a *real* Rock Shovel. The Northwest Dual Independent Crowd gives you more output in tougher digging because it utilizes force most other independent crowd shovels waste. The "Feather-Touch" Clutch Control gives ease of handling without the complications of pumps or compressors. Positive traction while turning as well as when going straight ahead assures better mobility whether on benches, on rough mine floors or on the rugged construction work of the mountains or desert. Add to these the Cushion Clutch, Uniform Pressure Swing Clutches, the easier upkeep made possible by simplicity of design and the fact that whether operating as a Shovel, Crane or Dragline the better balance of related parts assures smoother performance for a better day's work. These are among the things that have made Dodge Construction Company buy Northwests year after year. Sixteen orders is a lot of votes for dependability and output. Let us tell you more about it.

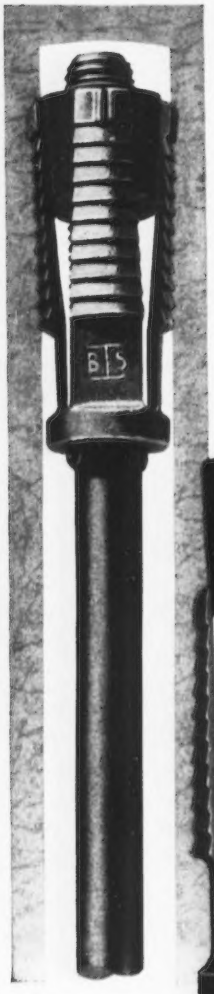
NORTHWEST ENGINEERING COMPANY
135 South LaSalle Street • Chicago 3, Illinois

NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem

Roof Bolts

MAKE A SAFER MORE EFFICIENT MINE



SQUARE HEAD ROOF BOLT

Furnished with expansion shell. Bolt has rolled threads and unchamfered head. For $1\frac{3}{8}$-in. hole. Pressed cars on shank support shell during anchoring. When bolt is tightened, leaves of shell expand, lock against sides of hole to provide holding pressure, and to prevent shell from turning.

You can make your mine a safer place for workers — and a better money-maker as well—by using Bethlehem Roof Bolts in entries, air-courses and rooms.

Bethlehem Roof Bolts contribute to improved safety and better operating conditions because they lock the roof in place by consolidating the overlying rock strata into a thick, single-unit beam. The danger of severe roof falls is minimized.

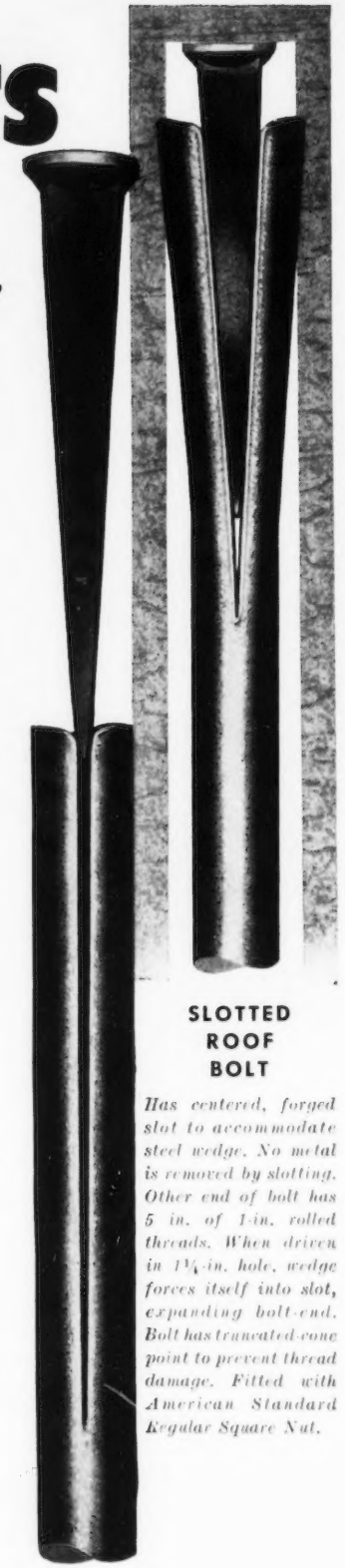
Bethlehem Roof Bolts also offer these other worthwhile advantages: (1) increased production (2) elimination of timber supports (3) improved ventilation (4) wider mine openings (5) greater side clearances, and (6) faster haulage.

To enable you to obtain these improved conditions, Bethlehem produces the two types of roof bolts shown. The bolts are made from new-billet steel, and come in lengths of from 2 ft to 8 ft. They can be installed either vertically or at angles. Full details may be obtained by writing to us at Bethlehem, Pa.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

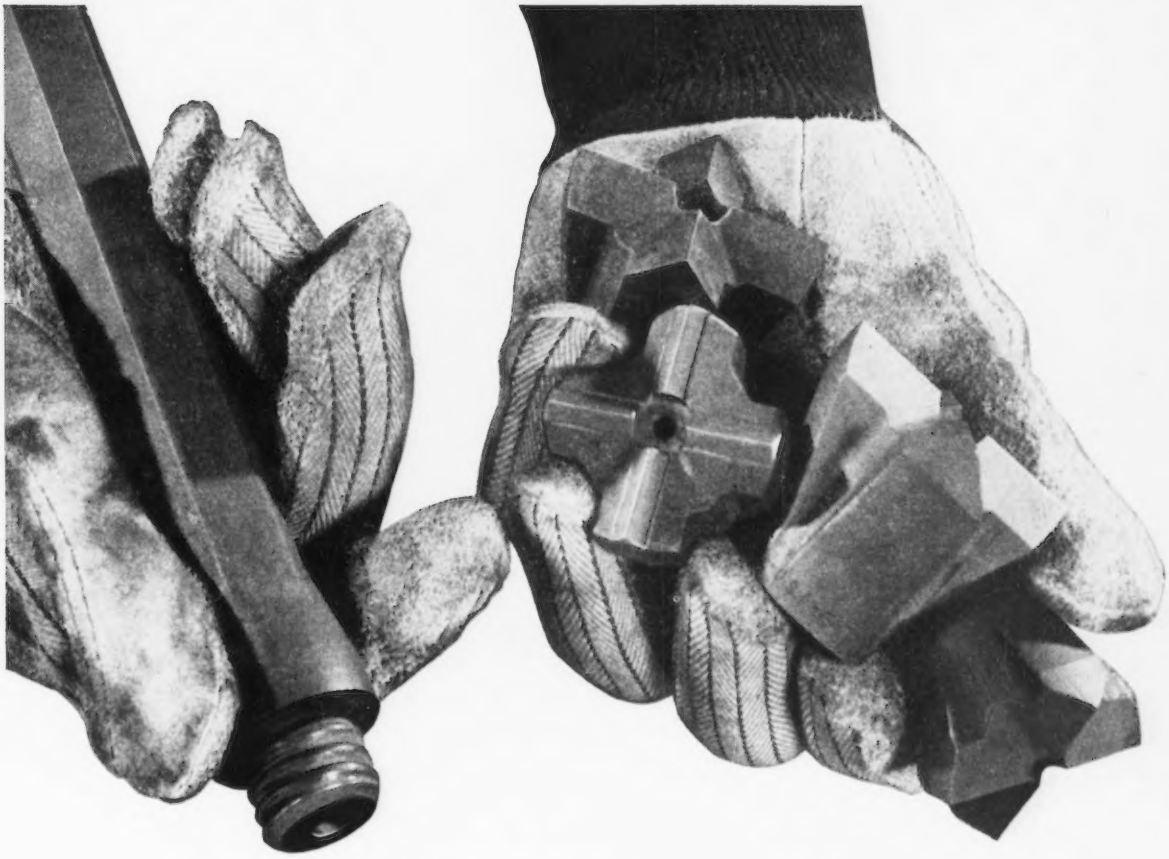


SLOTTED ROOF BOLT

Has centered, forged slot to accommodate steel wedge. No metal is removed by slotting. Other end of bolt has 5 in. of 1-in. rolled threads. When driven in $1\frac{1}{4}$-in. hole, wedge forces itself into slot, expanding bolt-end. Bolt has truncated-cone point to prevent thread damage. Fitted with American Standard Regular Square Nut.

BETHLEHEM MINE ROOF BOLTS

NOW! DOZENS OF DIFFERENT BITS FIT THE SAME DRILL STEEL!



YOU don't waste time switching steels, or waste money stocking an expensive inventory of different steels, when you use Timken® rock bits. Dozens of different Timken multi-use and carbide insert bits are interchangeable on the same drill steel!

With Timken rock bits, the driller quickly switches to the most economical bit as the ground changes, instead of wasting time going after another set of drill steels. It takes just a minute to unscrew one type of Timken bit—screw another bit on the *same* steel. No wasted time or motion.

Both Timken multi-use and carbide insert bits are made from electric furnace Timken fine alloy steel. And both types of bits have special shoulder unions that keep drilling impact from damaging threads.

Why not let our rock bit engineers analyze your drilling problems? They'll help you select the best bits for your particular job. You'll eliminate problems before they start, keep drilling costs to a minimum. There's no obligation. Write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

WHERE YOU CUT COSTS WITH TIMKEN MULTI-USE BITS

Most economical for ordinary ground. With correct and controlled reconditioning, they give lowest cost per foot of hole when full increments of steel can be drilled.

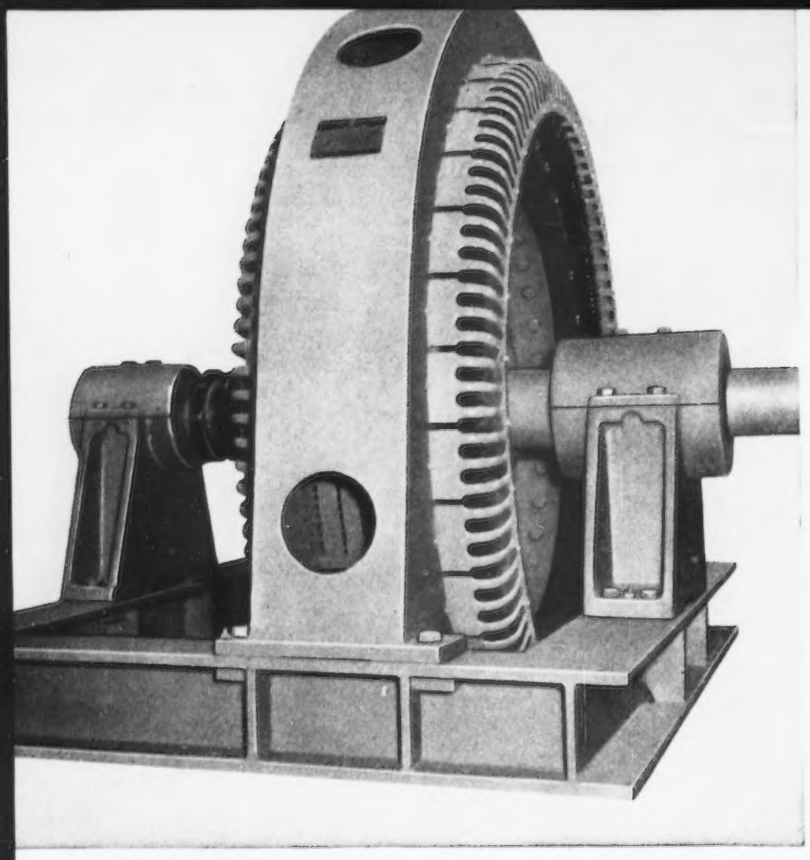
WHERE YOU CUT COSTS WITH TIMKEN CARBIDE INSERT BITS

Give highest speed through hard, abrasive ground. Also most economical for constant-gage holes, small-diameter blast holes, very deep holes.

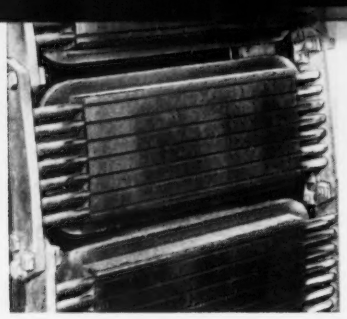
... your best bet for the best bit ... for every job

TIMKEN

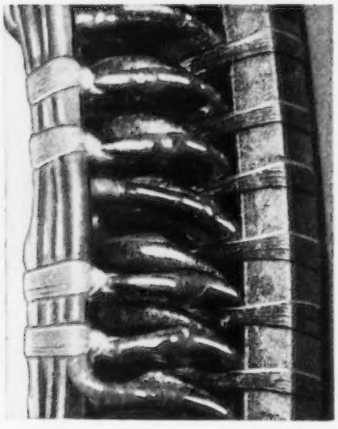
TRADE-MARK REG. U. S. PAT. OFF.



A G-E SYNCHRONOUS MOTOR, matched to your ball mill, is modern in design, neat in appearance, and built to give years of safer, more dependable service. Strength and rigidity are assured by fabricated construction and careful annealing of steel in rotors. Special coil and connection reinforcement gives extra protection to withstand the vibration and shock inherent in ball-mill operation.



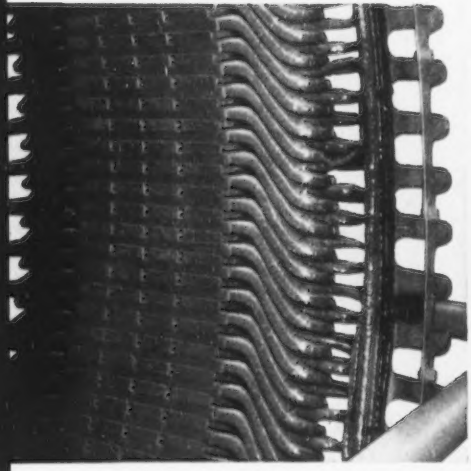
END SEGMENTS are sectionalized and securely bolted between poles. This rugged squirrel-cage winding assures more than ample strength for long motor life.



ARMATURE COILS are securely laced to an insulated support ring which, in turn, is rigidly attached to the stator frame.

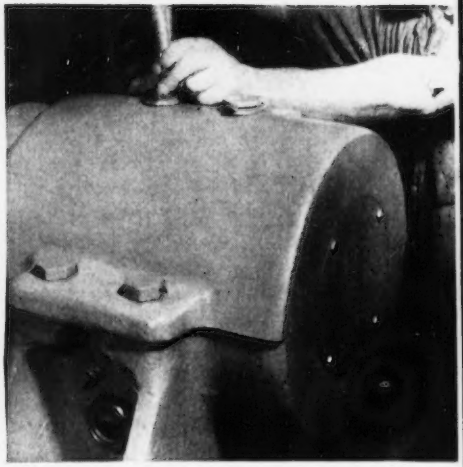
G-E Synchronous Motors Specially Designed

RAPID, ROUTINE MAINTENANCE MEANS LESS DOWNTIME BECAUSE . . .

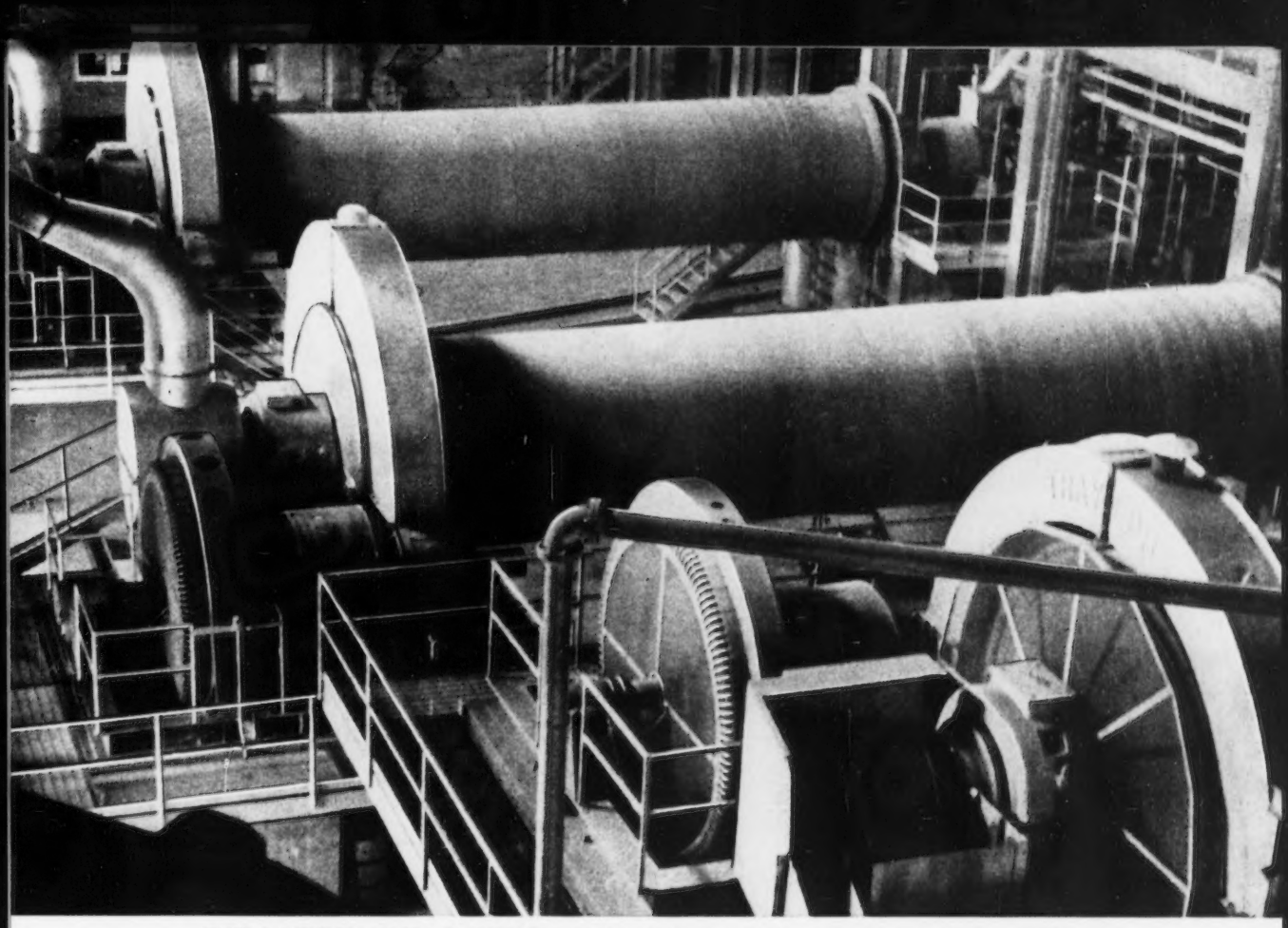


1 GLOSSY VARNISH on windings acts as moisture barrier, resists dust adhesion, cleans easily. Clean windings mean longer insulation and machine life.

2 BRUSH-PRESSURE ADJUSTMENT is fast and easy with spring-loaded holder. Brushes are staggered for uniform wear giving maximum collector-ring life.



3 SNAP-TOP COVERS and sight gage make lubrication fast and sure. These convenient features encourage regular checking of oil-level.



THREE G-E TYPE-TS, 180-RPM SYNCHRONOUS MOTORS DRIVE TRAYLOR BALL MILLS IN THIS LARGE WESTERN PLANT.

for Dependable, Economical Ball-mill Service

Ball mills are one of industry's "tough" drive applications. Motors must be able to meet torque requirements, withstand vibration, and run long periods without shutdown.

G-E synchronous motors are literally tailor-made to meet these requirements. Engineering and manufacturing experience obtained in building hundreds of motors for ball-mill drives and the proved dependable performance of G-E synchronous motors on all types of heavy-duty applications assure you of a motor that will withstand unusual demands and require only a minimum of maintenance expense.

Be sure to evaluate the special design features of G-E synchronous motors when you consider your next ball or rod-mill drive.

Contact your nearest General Electric office for bulletin GEA-5959—*Synchronous Motors for Ball and Rod-Mill Drives* or write to Section 770-30, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

Drill Operators prefer CP stopers *and* TUNGSTEN-CARBIDE BITS

Drill operators everywhere prefer Chicago Pneumatic's CP-34 Self Rotating Stoper because it has just-the-right combination of piston speed, foot-pound blow and rotating power to obtain maximum footage from long-life Tungsten-Carbide bits. The rugged CP-34 has all the plus features of heavier models, yet affords real ease of handling. Good balance, fast drilling speed, low air consumption and ability to stay on the job, make it a "must" for every mine.

For more information write,
Chicago Pneumatic Tool Company,
8 East 44th Street,
New York 17, New York.

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

"CUSHIONED" against wear

Reason Why Redwing-H Air Hose Gives Top Heavy-Duty Performance on the Job

You can depend on REDWING-H Cord Air Hose for longest, trouble-free service – even in the roughest kind of going in mines, quarries and construction operations.

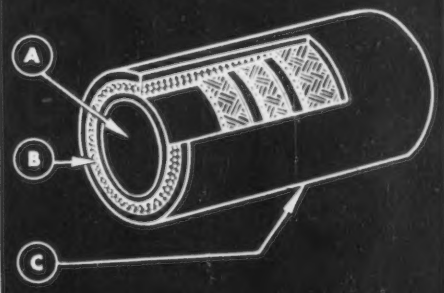
Reason is that this hose was developed by the G.T.M.—Goodyear Technical Man—to take hard knocks. Its cover—bright red in color—is resilient, tough stock that bounces away digs, cuts and abrasion. Under this super-strong cushion are multi-braids of high-strength rayon reinforcement—and a seamless, oil-resistant tube. Everything about REDWING-H adds up to longer, better service.

Ask the G.T.M. or your Goodyear Distributor about REDWING-H Cord Air Hose for your toughest jobs—available in continuous lengths, sizes from ½" to 1½" i.d. for working pressures from 200 to 350 lbs. psi. Write Goodyear, Mechanical Goods Division, Akron 16, Ohio.

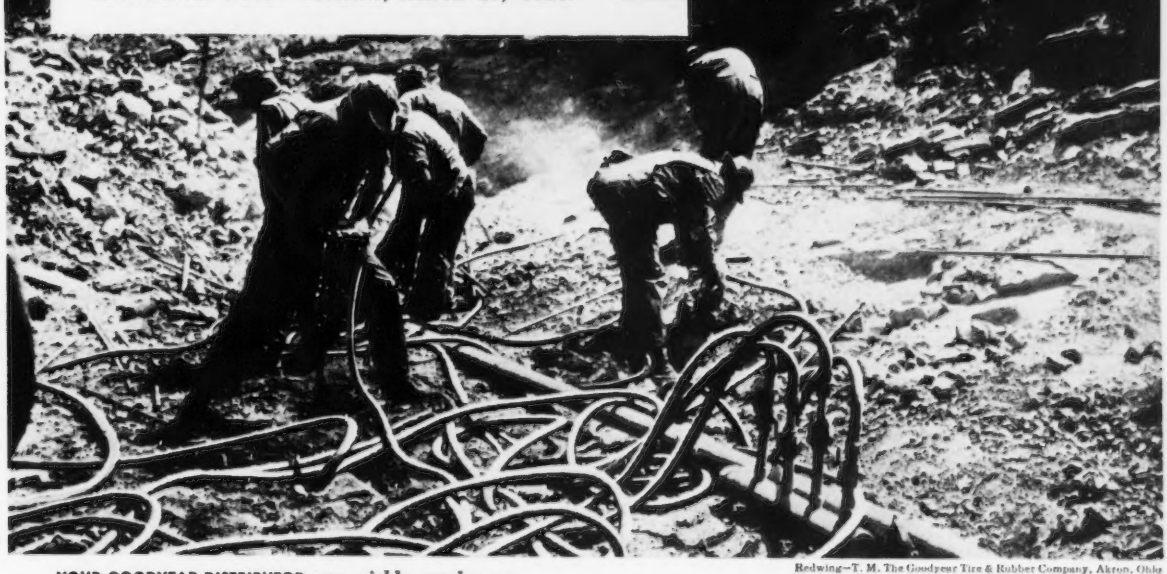
GOODYEAR INDUSTRIAL RUBBER PRODUCTS

-Specified

REDWING-H CORD AIR HOSE



- **A** Synthetic tube is seamless, non-porous, non-flaking, oil-resistant
- **B** Two or three braids of high-strength rayon reinforce against shock blows
- **C** Red cover of heavy, resilient stock bounces away abrasion, cuts, gouges



Redwing—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

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GOODYEAR

THE GREATEST NAME IN RUBBER

We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

HERCULES®

Pine Oil

FOR MAXIMUM RECOVERY

Hercules Yarmor® F Pine Oil has been a standard of quality among flotation frothers for over thirty years. It is still unequalled for its economy, for its strength and volume of froth, texture, and cell-life stability.

This low-cost flotation agent is an excellent frother for sulfide minerals such as the zinc, copper, nickel, iron, and lead sulfides. It is widely used in the flotation of gold ores and native metals. Yarmor F is also an excellent frother for use in the beneficiation of nonsulfide ores such as coal, mica, quartz, graphite, feldspar, phosphate rock, and talc.

For technical information on Yarmor F and other Hercules flotation aids, send for 16-page booklet, "Flotation and Hercules Flotation Agents."

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HERCULES POWDER COMPANY

INCORPORATED

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NM53-1

Where would you use this Tiger Brand Wire Rope?

THIS rope is more universally used than any other type of Tiger Brand Wire Rope. It is 6x25 Filler Wire Rope (6x19 Type N) Excellay Preformed.

We recommend it for the hoist ropes on pile drivers, cranes and derricks . . . for holding and closing lines on truck and crawler cranes . . . for boom ropes on derricks and shovels. And that's only a *partial* list of the jobs this rope can do especially well.

You can get it with a fiber core for ordinary jobs or with an independent wire rope core for tough jobs that require resistance to crushing. Excellay Preforming makes it easy to install and safe to handle.

A rope for every job

But, even this multi-purpose rope isn't the best one for *every* job. The thing to remember is that you can get the *correct* long-lasting Tiger Brand Rope for any job.

Free technical information

Our guide book, called "The Right Rope for the Job," helps you select the right rope every time. It lists all the most popular rope styles and shows you where to use each one. For a free copy of this helpful booklet, send the coupon.

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Please send me, without obligation, a copy of your valuable recommendation book, "The Right Rope for the Job."

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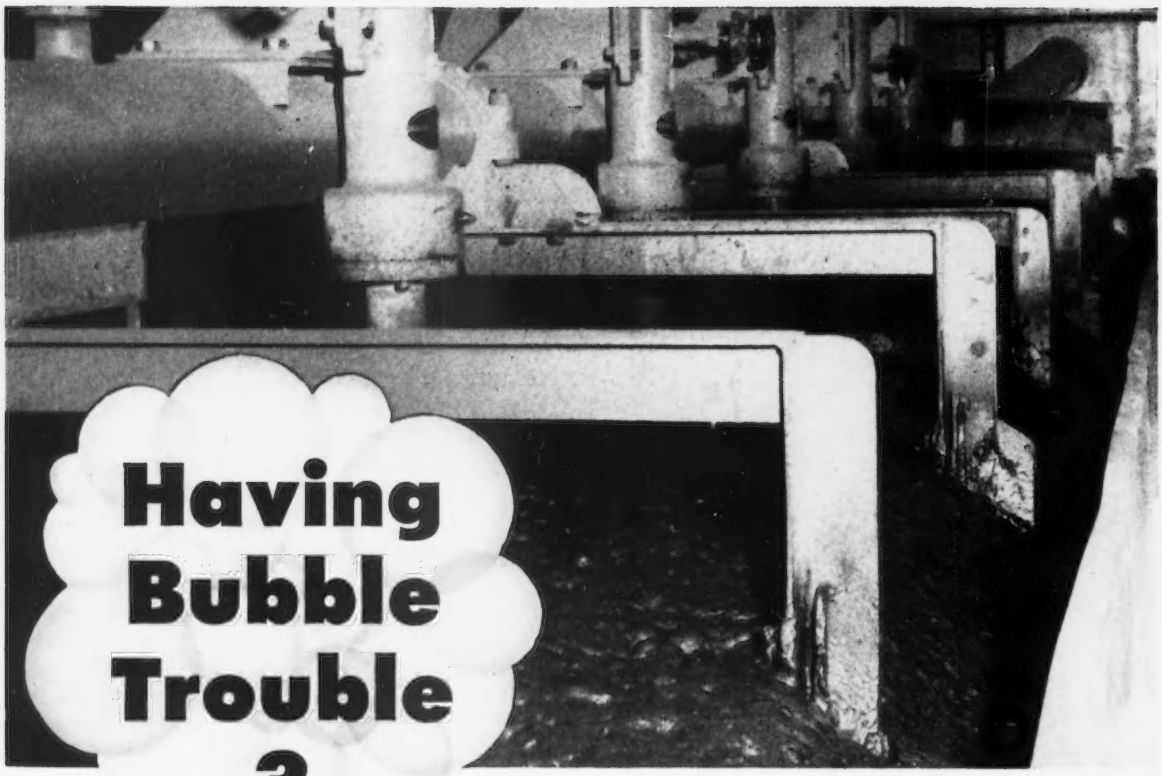
UNITED STATES STEEL



Having Bubble Trouble ?

Photo courtesy THE GALIGHER CO.

Bubbles in a flotation cell are very useful and wonderful. But when they spill over the launder and get onto the power cables, all kinds of trouble can result.

Power cables for flotation cell motors have an unusually difficult life. They are subject to alkaline solutions as well as exposure to oils. That's why we feel so strongly that you should use Simplex-ANHYDREX Cables to power your flotation cell motors. These cables have specially compounded neoprene jackets that are unusually resistant to oils and to chemicals of all types, both acid and alkaline.

The insulation, of course, is the famous Simplex-ANHYDREX insulation that will resist water and moisture for indefinite periods of time and still retain its electrical and physical properties.

For these reasons we believe that Simplex-ANHYDREX Cables will give longer, more satisfactory service than any other you can buy. Want to know more?

We'll be glad to send you a catalog!

Simplex WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.

Here's how ROCKMASTER® reduces noise

The noise your neighbors hear . . . and complain about . . . is air blast. It is the noise of wasted explosive energy that escapes into the air before it has done its job on the burden. Such noise is difficult to avoid when holes are spaced too closely and detonation begins at the top. This waste of power occurs because the explosives force seeks the path of least resistance.

By allowing initiation at the bottom of the holes, the ROCKMASTER Blasting System can keep the explosives force under prolonged confinement . . . as shown in the above photos taken at the height of four different ROCKMASTER blasts. Each photo shows considerable movement of burden with practically no escaping gases.

To see how the ROCKMASTER Blasting System can improve your blasting efficiency and reduce noise at the same time, send for your copy of the booklet, "Overburden Blasting Techniques."

The North Jersey Quarry Company erected this greenhouse at its Millington operation, 400 feet from the working face, to prove that its blasts don't break windows. The reduced noise and vibration of the ROCKMASTER *system helps them improve community relations.*

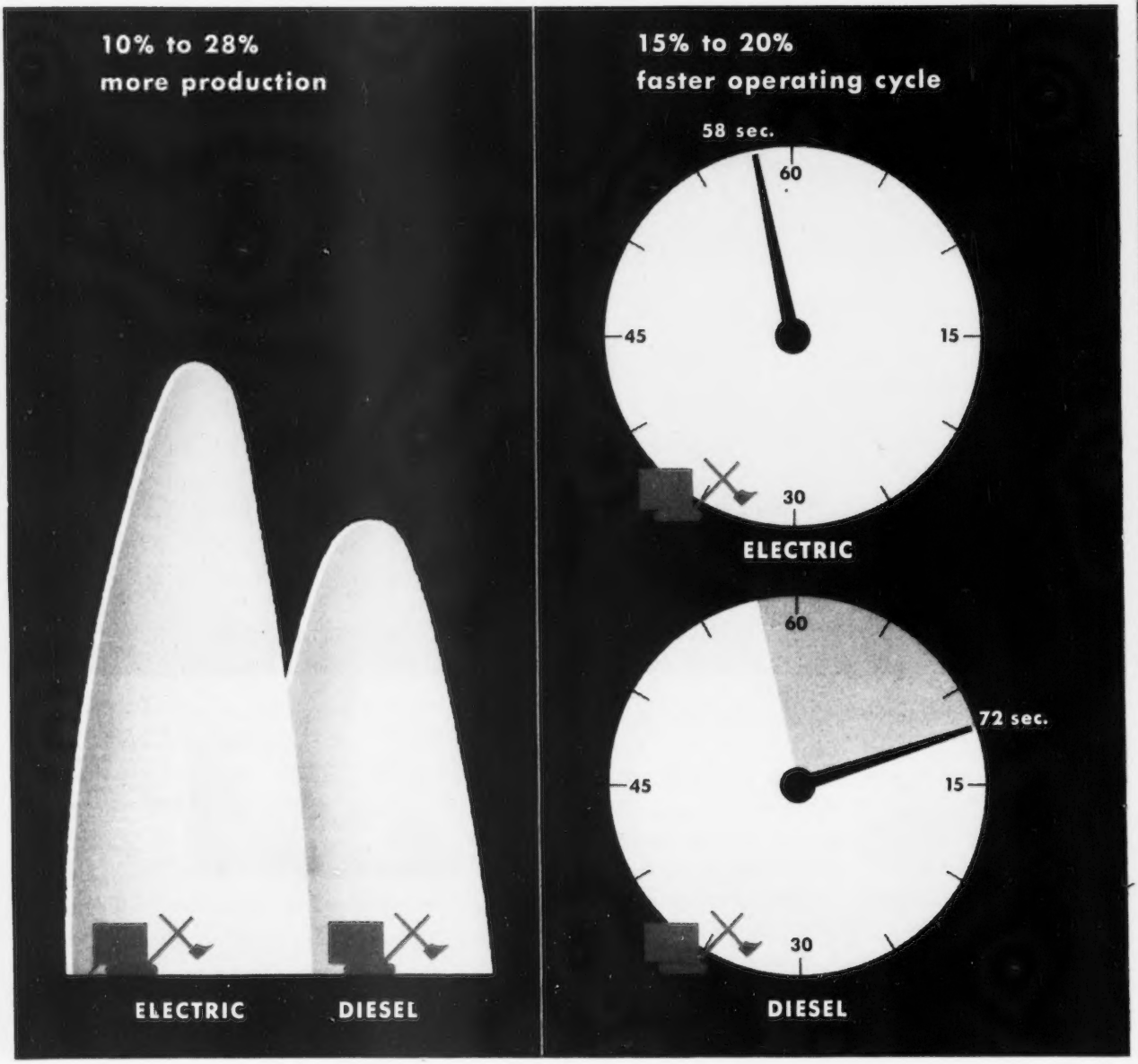
ATLAS

ATLAS EXPLOSIVES

"Everything for Blasting"

ATLAS POWDER COMPANY, WILMINGTON 99, DELAWARE

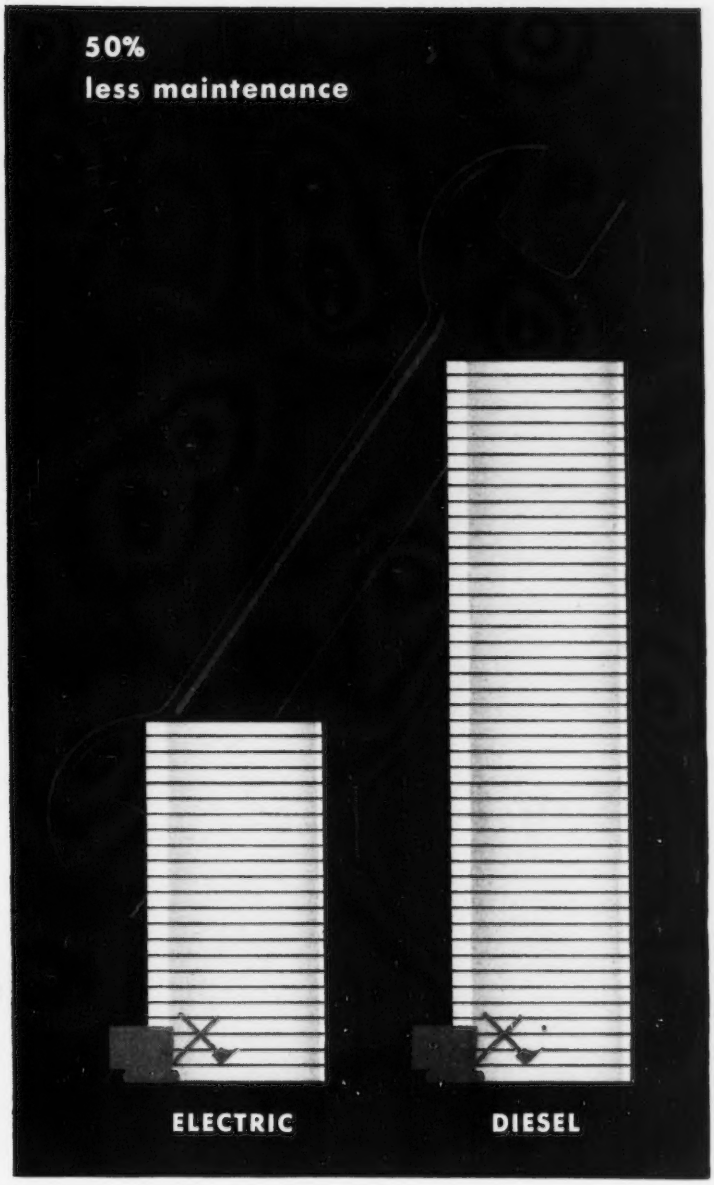
Offices in principal cities



10% to 28% more production—One shovel manufacturer studied both electric and diesel powered, 13 cubic yard units working under equal conditions. Results showed that the all-electric shovel was about 28% more productive. It's been proved that all-electric shovels and draglines will outproduce any other type by at least 10% in any size range from 2½ cubic yards up.

15% to 20% faster operating cycle—One reason for such fast performance is that all-electric units, unencumbered by mechanical brakes and slipping clutches, have an infinitely faster transmission of power. Precise speed and power control make it possible to design electric machines for much higher operating speeds than all other types of shovels and draglines.

Have you considered all the advantages of electric shovel operations?



50% less maintenance—One large shovel manufacturer has estimated that your maintenance of power equipment alone would be approximately 50% less if you switch to an electric shovel or dragline operation. Your savings in maintenance would amount to about $150 to $175 per month, based upon a 40-hour week, single-shift operation with a medium-sized machine.

Two leading shovel manufacturers, who build both electric and diesel powered units, say you can't beat electric drives for shovel performance. They agree that all-electric (Ward-Leonard type) shovels and draglines, such as Westinghouse-equipped machines, are the most productive types for any operation. These figures show why!

All-electric shovels and draglines give you:

10% to 28% more production
15% to 20% faster operating cycle
50% less maintenance

What about initial costs? All-electric shovels and draglines have a higher initial cost in smaller sizes, but actually cost less in the larger machines. However, even in the smaller sizes, the productive life of an all-electric shovel or dragline is roughly *double* that of comparable engine-driven unit.

Save money . . . Call Westinghouse before you buy!

If you're considering a new shovel or dragline, call your Westinghouse representative before you buy. He'll show you how Westinghouse-equipped shovels and draglines can give you these and other dollar-saving benefits. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-94995

YOU CAN BE SURE...IF IT'S Westinghouse

this costs money

Underloaded conveyors cost you money because they are not utilized to capacity . . . you're not getting full return on your investment . . . subsequent operations are starved for materials.

this wastes money

Overloaded conveyors cause unnecessary cleanup . . . thus waste labor. Subsequent operations are periodically flooded with more material than they can handle.

this saves money!

A properly loaded conveyor, with flow to it regulated by a Rex® Feeder, is economical and efficient . . . promotes smoothness and economy throughout entire processing operation.

YOU save time, material, money with CHAIN BELT REX COMPANY® apron feeders!

Uniform, Regulated Flow . . . that's important when you're concerned with moving bulk materials from bin or hopper to belt conveyor or crusher. With Rex Feeders you're assured a metered, uniform rate of transfer, regardless of variation in size of material handled. Your belt conveyor or crusher will receive a steady flow of material to assure smooth, efficient, low-cost operation.

Ask your Rex Field Sales Engineer to give you complete information on how you can save money with Rex Feeders. Call the office nearest you, or write to Chain Belt Company, 4679 W. Greenfield Ave., Milwaukee 1, Wis.

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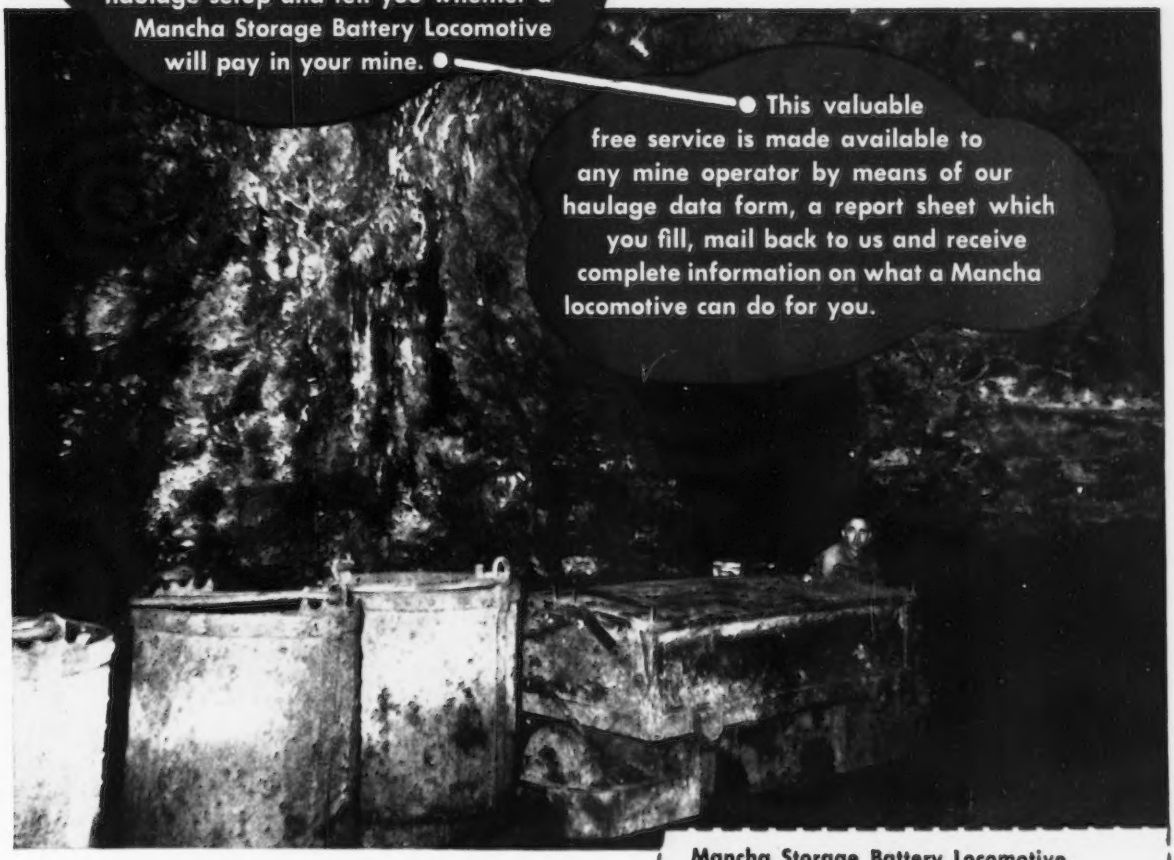
You know *in advance* what to expect from a

MANCHA STORAGE BATTERY LOCOMOTIVE

Before you buy — even before you decide to purchase new haulage equipment — Mancha engineers will analyze your haulage setup and tell you whether a Mancha Storage Battery Locomotive will pay in your mine.

This valuable free service is made available to any mine operator by means of our haulage data form, a report sheet which you fill, mail back to us and receive complete information on what a Mancha locomotive can do for you.



Scores of mine operators have gained important haulage economies by taking advantage of Mancha's service. You can do the same without placing yourself under the slightest obligation.

Mail the coupon. Get your mine haulage data form now.

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MANCHA STORAGE BATTERY LOCOMOTIVE
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Colitz Coal Co. replaces

To uncover vertical anthracite veins near New Philadelphia, Pennsylvania, Colitz Coal Co., Inc., Pottsville, is stripping 350 ft. of dirt and rock under really tough conditions. Overburden, largely conglomerate rock, weighs from 2670 to 3400 lbs. per cubic yard. Haul of 1000′ to spoil pile is all uphill, with grades averaging 20%. Haul roads are rough and contain a series of 90° switchbacks. "This is considered one of the toughest jobs in the region," says Co-Owner John Colitz. "It's *all* grades."

To lick such grueling conditions, Colitz Coal Co. purchased 3 big 50-ton "A" Tournarockers. After a year's operation with these giant Rear-Dumps they report output like this:

Move 40 to 51-ton loads up 20% grades

Loaded by a 6-yd. shovel, Tournarockers get an average yield of 30 cu. yards per load, according to company records. On a weight basis, that's 40 to 51 tons per load, depending on the material. In good weather and bad, the year around, the Colitz rigs keep hauling these big loads up the 20% incline — 7½ hours per shift, 3 shifts per day, 6 days per week. Says Mr. Colitz, "We make as high as 50 trips per shift on this steep cycle. If we didn't have these 3 Tournarockers, we'd have to use 10 other haulers."

Tournarocker's simplicity of design and unusual maneuverability give Colitz Brothers other valuable savings, too. Maintenance crews report these rigs can be completely greased in 2 hours (as compared with an entire 8-hour shift required to grease competitive trucks). Also, Tournarockers are able to get around sharp right-angle cutbacks without backing for a second try — something other rigs could never do. With 90° power steer, fingertip electric controls, and 4-wheel, multi-disc air brakes, Tournarockers

LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

Tournarocker dumps load clean over bank, needs no dozer clean-up. Front-wheel drive, multi-disc 4-wheel air brakes (with 9408 sq. in. total braking surface) assure perfect safety.

Giant 50-ton Tournarocker is loaded with 40 to 50 tons of blasted conglomerate rock by 6-yd. shovel. 13′ x 17′ bowl target speeds shovel swings, reduces spillage.

10 trucks with 3 Tournarockers

get under the shovel faster . . . position for dumping faster . . . and return to shovel faster.

"Cut operating costs 40%"

With performance like this, Colitz has assigned most of his hauling work to the Tournarockers . . . uses the four 12 and 15-ton trucks remaining from his earlier haul fleet for emergencies only. Company records show that 95% to 98% of total overburden moved in the past year was hauled by the 3 Tournarockers. *"Costs are low, too,"* says Mr. Colitz. *"Since using Tournarockers, we've cut operating costs by 40%!"*

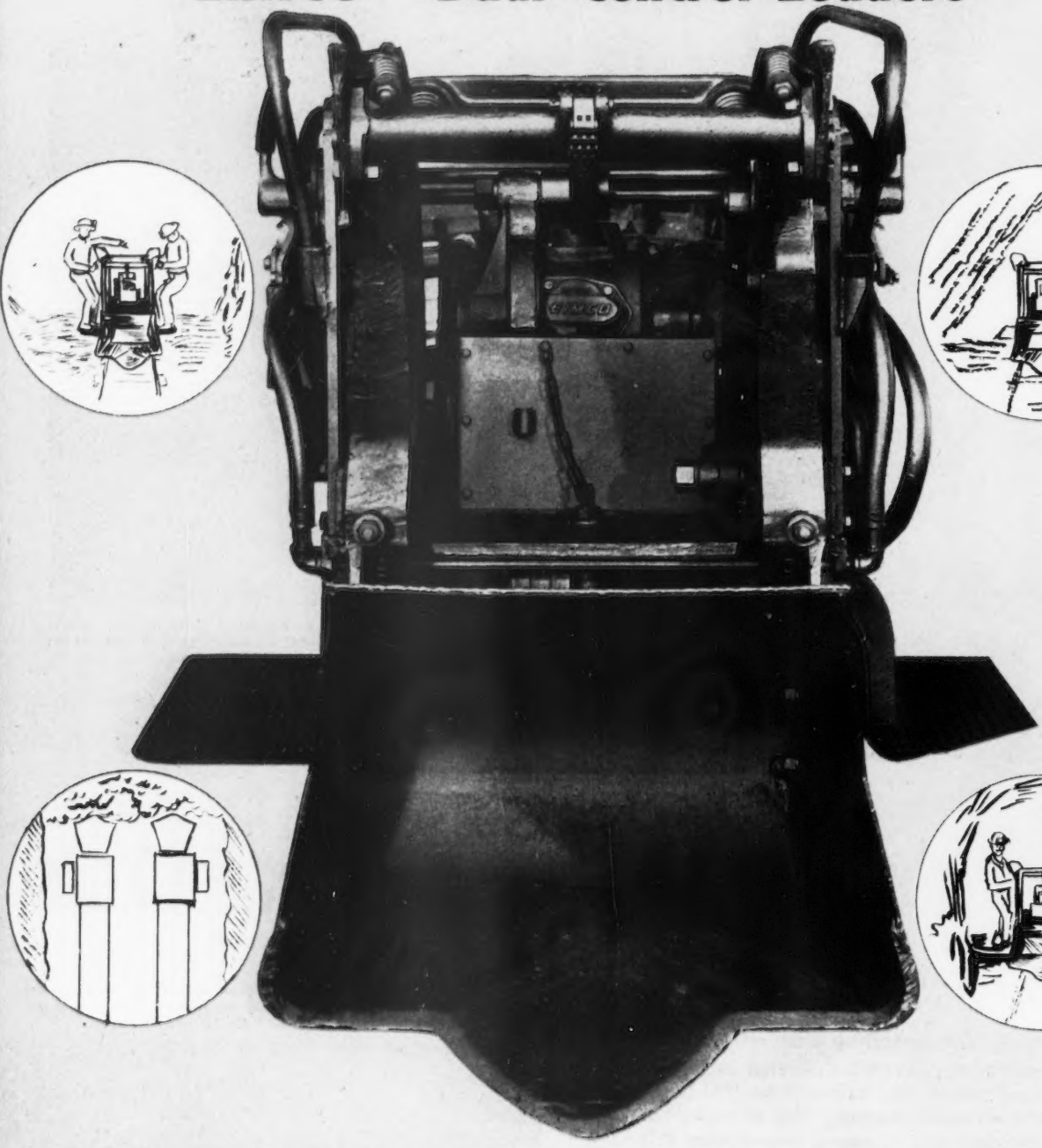
Whatever kind of shovel-loaded material you have to haul, it will pay you to compare your present output with that reported by Tournarocker owners. Ask your LeTourneau-Westinghouse Distributor for complete facts on Tournarockers. There's a size to fit your needs — 9 to 50 tons.

Tournarocker—Trademark Reg. U.S. Pat. Off. AR-301-CM

Loaded with 30 yds. of overburden, rig starts 1000′ haul up continuous 20% grade. Return is made down same grade. With power steer through geared kingpin, these 50-ton units can turn around in a radius of 15′8″ — less than half their 36′ overall length.

HIGH-SPEED, RUBBER-TIRED HAULING • EXCAVATING • LIFTING EQUIPMENT

EIMCO — Dual-Control Loaders



Mining companies, operating their own schools of instruction have found that it is easier to teach with equipment prepared for dual operation.

Eimco offers its dual control machines for that purpose but they have also been found to be a practical tool for many operations underground:

Around curves where track has been laid close to one side of the crosscut, under hanging walls, working both ways from the shaft in a pitching vein. For safety in old workings—under chutes, or in bad ground, under piping or air vents and in double track systems.

Eimco Dual-Control units work equally well from either side providing usual outstanding performance of all Eimco air powered loading equipment.

EIMCO 1484

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

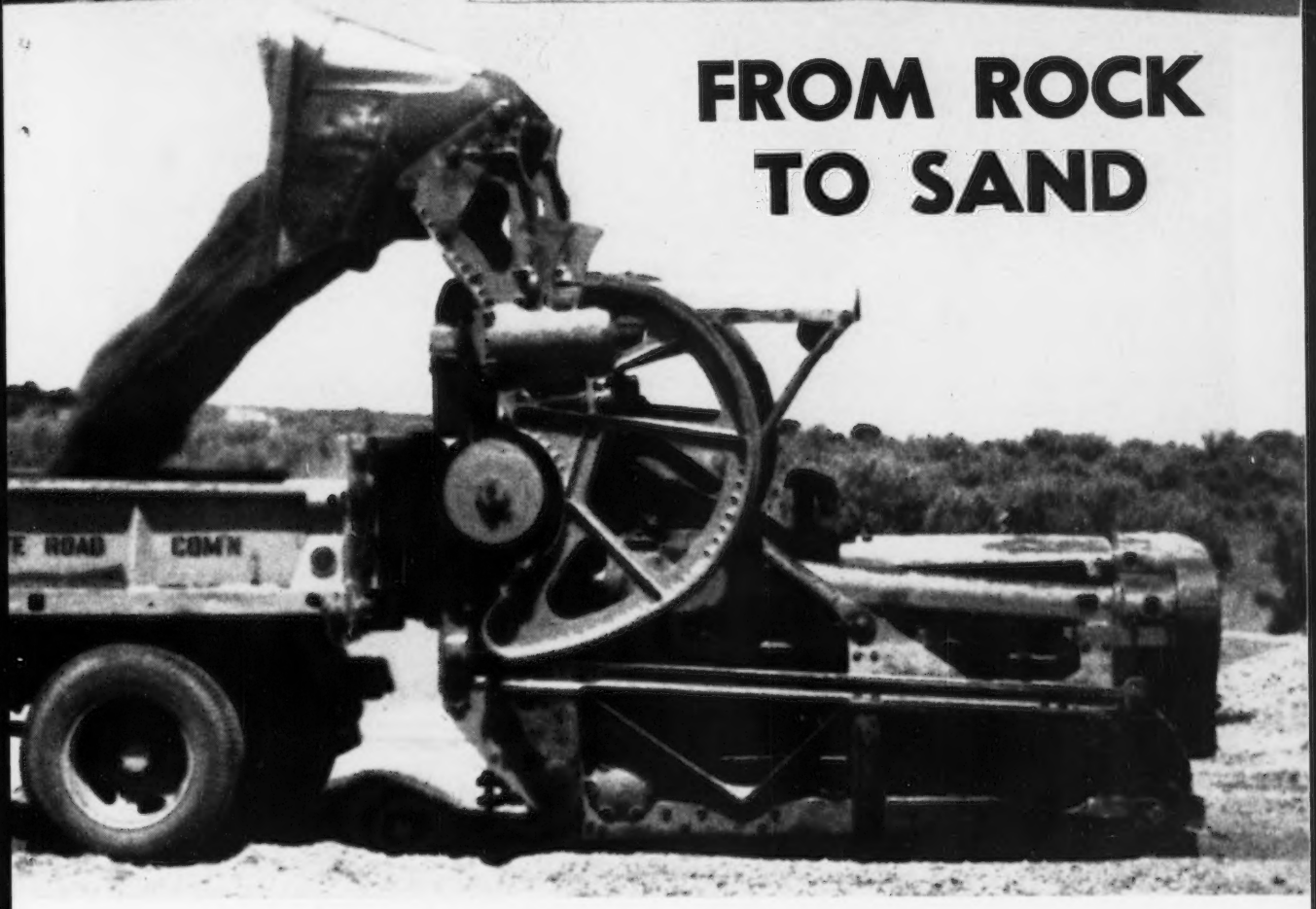
EXECUTIVE OFFICES AND FACTORIES - SALT LAKE CITY 10, UTAH, U. S. A.

BRANCH SALES AND SERVICE OFFICES:

NEW YORK, 51-52 SOUTH STREET • CHICAGO, 3319 SOUTH WALLACE STREET
BIRMINGHAM, ALA., 3140 FAYETTE AVE. • DULUTH, MINN., 216 E. SUPERIOR ST.
EL PASO, TEXAS, MILLS BUILDING • BERKELEY, CALIF., 637 CEDAR STREET
KELLOGG, IDAHO, 307 DIVISION ST. • LONDON W. 1, ENGLAND, 190 PICCADILLY

IN FRANCE: SOCIETE EIMCO, PARIS, FRANCE
IN ENGLAND: EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
IN ITALY: EIMCO ITALIA, S.P.A., MILAN, ITALY

FROM ROCK TO SAND



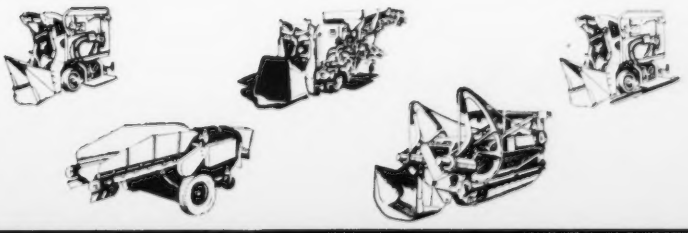
Heavy loading jobs require Eimco machines designed and built for heavy work. Eimcos were built to load rock and stay on the heavy jobs where other equipment fails.

Rock digging and loading in blocky, abrasive ores underground or on the surface at the rate of three to four yards per minute is average. They run forward to dig and load — backward to discharge overhead.

Every job can use one or more Eimcos for stockpile loading, bulldozing, digging in narrow places, loading trucks, etc. They're ideal for highway clean-up jobs. They dig and load economically in rock, sand, gravel, sticky clays and other materials and discharge the bucket clean into trucks or railroad cars.

Write for information.

EIMCO



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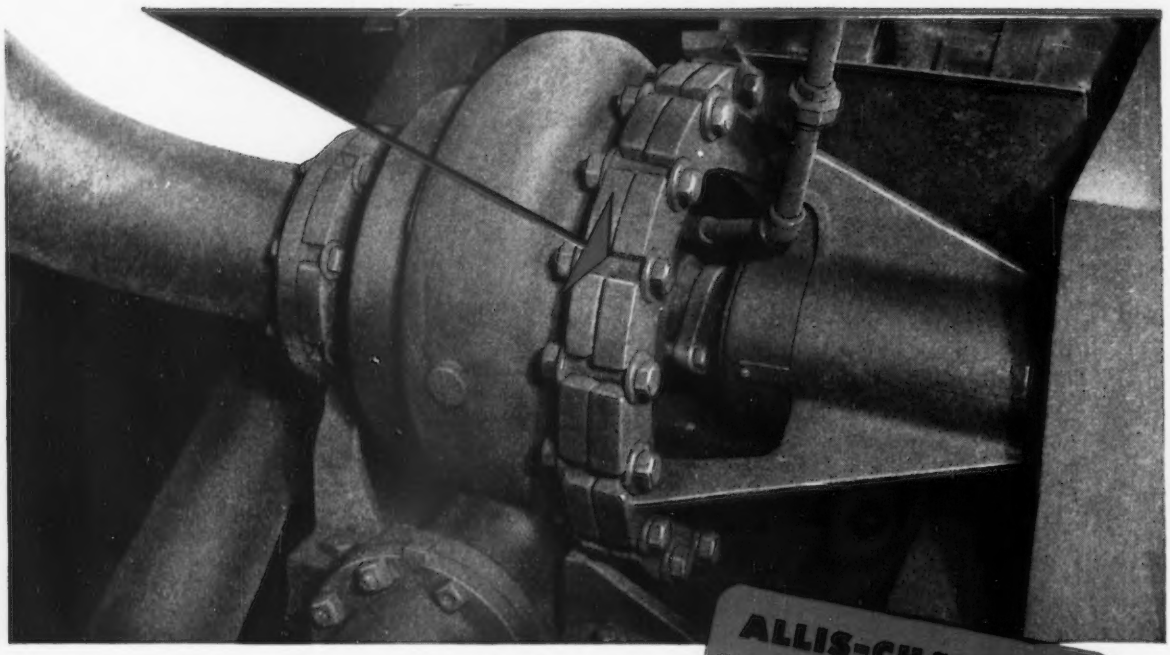
Here's a Pump That Maintenance Men Like



ALLIS-CHALMERS Solids Handling PUMP

- **All maintenance points are easy to reach**
- **Pump can be taken down and returned to service in less than a half hour**
- **Many parts are interchangeable between different pump sizes**

THE Allis-Chalmers solids handling pump is ruggedly built to stand rough solids handling service. And it's easy to work on. Notice how accessible the packing gland is. See how the casing bolts are arranged. Just loosen the nuts a couple of turns and the bolts lift out.

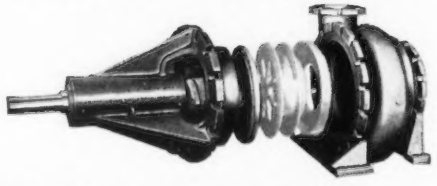
Wearing parts separate into easily handled units. In fact, one man can tear down an Allis-Chalmers solids handling pump, replace a part and have it back in action again *in less than a half hour*. Piping need not be disturbed unless the casing is replaced.

Complete Pumping Unit Furnished . . . Allis-Chalmers can furnish the complete pumping unit — pump, motor, *Texrope* drive and control — assembled and ready to install and run. A *Vari-Pitch* V-belt drive makes it possible to vary head and capacity at the turn of a crank.

Get the Complete Story . . . Every Allis-Chalmers solids handling pump is application engineered by a specialist who knows solids handling equipment problems and how to solve them. Your nearby Allis-Chalmers representative will be glad to give you complete facts and figures on CW pump performance. Or write Allis-Chalmers, Milwaukee 1, Wisconsin and ask for Bulletin 52B6381.

A-4137

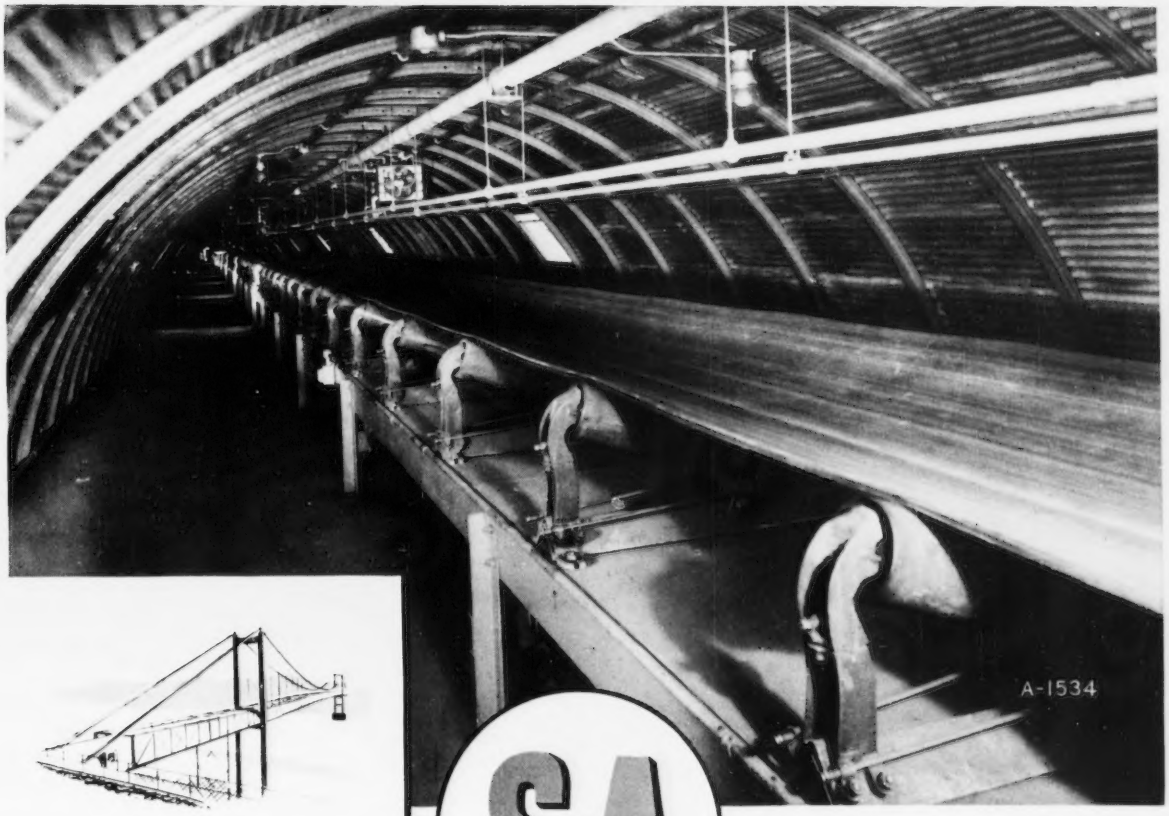
NOW . . . even longer wear



Impeller and suction plate now made of *Ni-Hard* alloy at no extra cost. You get longer wear, lower pumping costs.

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS



Carries a River of Coal Across a River...

2000 tons per hour—that's the capacity of this river-spanning conveyor. Coal is carried from mines across a river to the processing plant. Speed of the 60-inch belt shown is 600-feet per minute. Conveyor is supported by a suspension bridge with a 720-foot center span, which makes it the longest conveyor suspension bridge in the world. A 20-foot wide continuous Quonset hut covers conveyor and provides heated walkway for servicing.

S-A Carriers are available in a wide variety of sizes and arrangements—with or without extended grease pipes engineered to meet specific operating conditions. Ask an S-A engineer for full details or write for catalog 116.

S-A CARRIERS

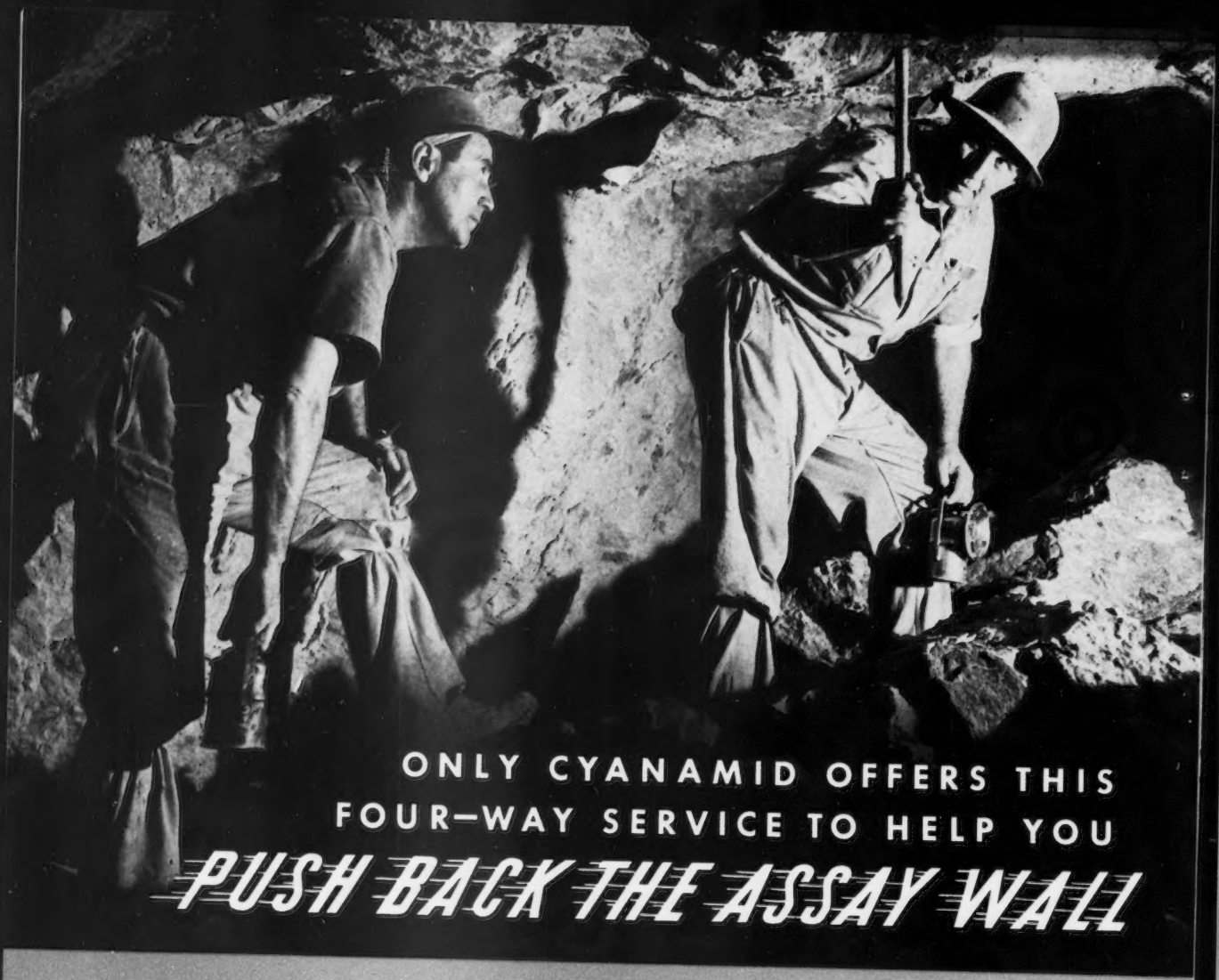
at World's Largest Heavy Media Preparation Plant

When carriers are chosen for almost 3/5 of a mile of 54 and 60-inch conveyor belts at the world's largest heavy media preparation plant, thousands of dollars in maintenance and power costs are at stake. To keep these costs at a minimum—year after year—Jones and Laughlin Steel Corporation chose S-A Carriers for its mammoth LaBelle, Penn. installation. Designed for heavy duty service, the Carriers are the live shaft type with 6-inch rollers.

This is but one of hundreds of high volume material handling installations that depend on S-A Carriers for low maintenance, power saving conveyor operation. When high volumes magnify the importance of your conveyor operating costs, make sure you move material at the lowest cost per ton—make sure with S-A Carriers.

STEPHEN S-A ADAMSON MFG. CO.
4 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT



ONLY CYANAMID OFFERS THIS FOUR–WAY SERVICE TO HELP YOU PUSH BACK THE ASSAY WALL

On every stope assay limits change whenever metal prices or "cost plus tails" fluctuate. With today's costs and current metal prices moving the assay wall ever nearer the working face, even a small decrease in tails can have a profound effect on profits . . . and on ore reserves!

In your continuing efforts to improve metallurgy, Cyanamid can give you very practical four-way help . . .

1. REAGENTS

Cyanamid alone offers a most complete line of chemicals, both for cyanidation and flotation. With Cyanamid's long line of reagents you never need compromise one iota on the exact reagent combination for highest recovery.

In promotors, for example, Cyanamid offers a choice of twenty-two Aerofloat* and Aero** Promotors plus a complete line of Sodium and Potassium Xanthates. Also available are a variety of Aerofroth† frothers, Pine Oil and Cresylic Acid.

Year by year, Cyanamid has developed such noteable special purpose reagents as the 600 Series Depressants, the 400 Series, and the 800 Series Promotors for oxidized metallic and non-metallic ores. New methods have also been developed which have wide application for thickening and filtration of ore and other pulps. Other reagents are being aggressively researched.

2. FIELD ENGINEERS

Backed by the technical resources of Cyanamid Mineral Dressing Laboratory and kept constantly informed of progress in every mining field, Cyanamid Field Engineers are literally "walking encyclopedias" of current beneficiation practice.

But, by the same token, they are eminently practical mill men who can give you in-the-mill shirt-sleeves service on perplexing treatment problems. Their primary job is to help you work out the most efficient reagent combination and flow scheme.

3. DELIVERY SERVICE

To implement our application service, we maintain substantial warehouse stocks of metallurgical chemicals for cyanidation and flotation at strategic points. Frequently, mills can achieve substantial savings through lower-cost combination shipments and better balanced reagent inventories.

Through periods of world upheaval spanning thirty-six years, Cyanamid has maintained deliveries world-wide ...a record of dependable service which we will do everything humanly possible to perpetuate.

4. PROCESSES

Since crushing and fine-grinding are so large a part of over-all milling costs, elimination of gangue at the coarsest possible size offers a fruitful field for cost cutting.

Cyanamid offers the two most advanced and efficient mechanical processes for this purpose: *Heavy-Media Separation Processes* and *Dutch State Mines Cyclone Separator Processes.* Both employ unique, exclusive principles to achieve accurate, low-cost separation not obtainable by older methods. These processes have been used on millions of tons of a wide range of minerals as low-cost methods of pre-concentrating ore or tailings prior to froth flotation or other treatment, and to produce directly-marketable concentrates.

*Reg. U. S. Pat. Off.
**AERO is a trade-mark of American Cyanamid Co., applied to Xanthates, promoters, depressants, reagents, etc., for use in the flotation of minerals.
†Trade-mark.

AMERICAN Cyanamid COMPANY

MINERAL DRESSING DIVISION

30 ROCKEFELLER PLAZA NEW YORK 20, NEW YORK

These Valves Last Longer-at Lower Cost ...on Toughest Water Services for instance

THE INSTALLATION

In a Southern public utility's power plant, with Crane Diaphragm Valves on water spray lines for cleaning traveling screens on condenser water intake.

VALVE SERVICE RATINGS

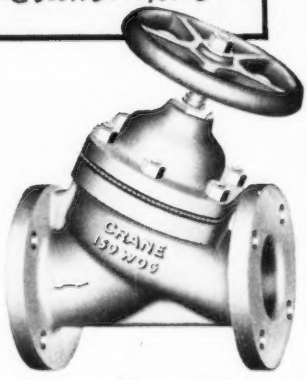
SUITABILITY:	Ideal for the job
FEATURES:	Packless – No stuffing box
MAINTENANCE COST:	None
SERVICE LIFE:	Show no wear after more than 3 years
OPERATING RESULTS:	No leakage – easy operation
AVAILABILITY:	Regular Crane item – No. 1611

THE CASE HISTORY

Both raw Mississippi River water and deep well water are used for the cleaning spray to the screens. The valves are exposed to a combination of river water sand erosion, and well water sodium chloride corrosion. These conditions caused stem packing leaks, difficult valve operation, and also corroded the steel bonnet bolts. Maintenance costs were excessive.

The trouble was stopped by installing Crane No. 1611 Packless Diaphragm Valves featuring separate disc and diaphragm design. After more than 3 years' operation, they show no effects of service. They operate smoothly and seat tightly. Crane Diaphragm design eliminates leaks entirely, and no maintenance has been needed. Based on this performance record, additional Crane Diaphragm Valves have been installed.

THE VALVE



In Crane Packless Diaphragm Valves, the diaphragm seals the working parts from all erosive or corrosive fluids. Need for a stuffing box is eliminated. Choose these valves from a wide variety of body and trim materials, lined or unlined, for better, lower-cost handling of countless corrosive, erosive, or ordinary services. See your Crane Catalog or your Crane Representative.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Even the Ancient Chinese had a Yen for Parking Meters

Time wasn't very valuable in ancient China but hot water was, because fuel had been scarce ever since anybody could remember. So, when a fastidious citizen parked himself in the community tub and called for the Saturday Night Special, one of the boys clocked off the hours on the very quiet-running timepiece above. This simple clock consisted of four copper tubs with water dripping slowly from one tub to the next. In the bottom one, a float, rising with the water, indicated the time—and hot water consumption—on a scale. It wasn't very accurate but five hundred years ago it was considered a marvel of ingenuity. It's much easier to keep accurate tab on operating costs today, and in the drilling business, those costs are always appreciably lower when Truco Diamond Bits are on the job. Their irresistible cutting power takes them through any formation, swiftly, accurately, thriftily, dependably. They are used profitably in every phase of drilling. May we send you our catalog?

WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue Detroit 6, Michigan

WHEEL TRUEING TOOL CO. OF CANADA, LTD.
575 Langlois Avenue Windsor, Ont., Canada

Here's

S11 on standard feed leg. Weight, 90 lbs.

S11ST Offset telescopic-leg stoper. 28" — 40" — 52" feeds. Some mines drill 36- to 40-foot holes, using coupled steels.

S11S Offset stoper.

Le Roi-CLEVELAND "Offset" Stopers

make roof bolting faster, easier

- **Complete range of sizes** for every mining condition including low coal.
- **Durability** keeps Le Roi-CLEVELAND Stopers underground.
- **Easy to handle** — fast drillers.
- **Trip rotation** lets you use the same stoper for driving roof bolts that you use for drilling.

why...

. . . stoping operations go faster and cost less, when you use Le Roi-CLEVELAND Stopers

FOR all raise or any uphole-work, drilling goes better with a Le Roi-CLEVELAND Stoper on the job.

Now, why is that? On the surface, a Le Roi-CLEVELAND looks pretty much like other makes of stopers. But—see a Le Roi-CLEVELAND in action. Actually use it. Then you can tell the difference.

It all boils down to one thing — Le Roi-CLEVELAND *design*. Right there, you have the basic reason why Le Roi-CLEVELAND Stopers produce extra footage per shift . . . why tonnages are greater . . . why mining and maintenance costs are lower.

Le Roi-CLEVELAND Stopers are available in 90- and 120-lb. sizes, to meet every mining condition. Ask your Le Roi representative for detailed information on the units that meet your particular needs. See him soon.

Write for free Bulletin No. RD25.

CLEVELAND ROCK DRILL DIVISION

Le Roi Company

A Subsidiary of Westinghouse Air Brake Co.

12500 BEREA ROAD • CLEVELAND 11, OHIO

Plants: Milwaukee, Cleveland and Greenwich, Ohio

Trouble-free performance is built right in

☆ End-seating valve has short travel. Its snappy action provides powerful blow, strong rotation, and fast drilling speed. Air consumption is low and valve efficiency is not affected by wear.

☆ Air-feed relief control trigger is close to operator's thumb as he holds the handle grip. Slight pressure on the trigger eases up on the air feed — more pressure drops the drill back slightly, or returns it to its fully closed position.

☆ Inside of air-feed cylinder is polished, to provide free action and insure longer life for cup leathers.

☆ Trip rotation lets the operator stop and start rotation at will — a big help in collaring the hole. It's a safety factor, too: When a steel sticks suddenly, the pull of the rotation on the operator's hand turns the hand-grip sleeve, stopping the rotation before the machine can cause injury.

☆ Air-feed piston is an integral forged tube — not welded or brazed.

☆ Constant blowing around the steel keeps cuttings out of the chuck.

☆ Rotating sleeve and spacer are built to withstand wear and fatigue.

☆ Efficient lubrication protects all surfaces, adds to the dependability of Le Roi-CLEVELAND machines.

RD-34

NEW TRENDS IN MINING MECHANIZATION

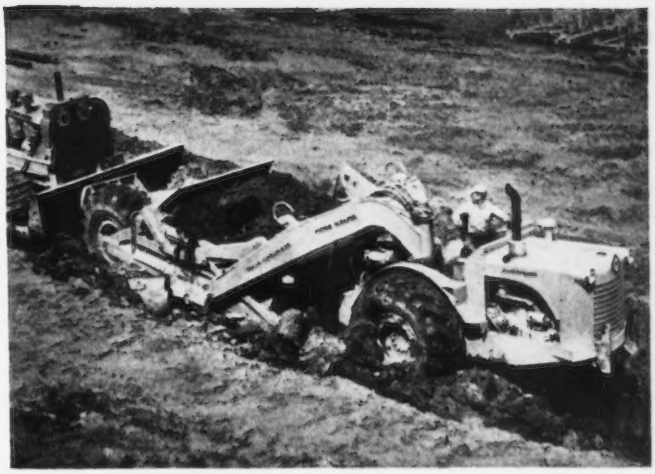
Stockpiles processed ore. HD-20 Tractor also builds access roads . . . maintains tailings dumps . . . cleans up around shovels . . . cuts drainage ditches . . . digs sludge basins and sluice-ways . . . builds reservoirs and pond dams . . . clears and levels building sites . . . tows equipment.

Loads ore underground. HD-5G Tractor Shovel also loads sand and gravel, other bulk materials . . . cleans up around conveyors and hoppers. Special materials buckets, bulldozer blades, other attachments available. Tractor shovels available for all sizes of Allis-Chalmers crawler tractors.

Builds and maintains haul roads. AD-40 Motor Grader levels pit bottoms . . . digs and grades for drainage . . . scarifies . . . prepares dragline sites. Gasoline-powered Model D Grader also available. Handles routine road maintenance — light construction, etc.

TODAY'S demands on mining production require the selection of equipment of the broadest versatility. Allis-Chalmers offers a complete range of material moving and handling equipment — including four sizes of diesel crawler tractors, motor graders, pull scrapers, high-speed Motor Scrapers and Motor Wagons — designed to fit your particular mining applications and to deliver the highest possible output.

Here are some on-the-job views with a few of the many ways in which these modern machines are speeding production and lowering costs.



Strips overburden. 13-yard heaped capacity TS-200 Motor Scraper also loads, hauls material from open pit . . . clears and levels for camp sites and drill setups . . . levels and grades building sites . . . hauls in supplies. Larger 18-yard heaped capacity TS-300 also available.

Hauls rock overburden. TR-200 Motor Wagon hauls tailings, sand, gravel, silicon, lead and zinc ore. Unit travels fast "off-road" with capacity loads . . . dumps clean every time with 18-ton, hydraulic-controlled rear-dump body. Sides channel-ribbed for rigidity.

Levels tailings dump. HD-20 Tractor with pull-type scraper also loads and hauls ore-bearing material — handles large-scale stripping jobs. Exclusive Allis-Chalmers hydraulic torque converter on HD-20 gives higher output, less upkeep on pulling, pushing and dozing work.

Complete line of pull-type scrapers available, from 2-yard to 18-yard sizes.

Your Allis-Chalmers dealer will be glad to analyze your equipment needs and help you select the right machines for your jobs. See or phone him soon to watch these machines in action.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Sanford-Day... the mining industry's Super

POTASH CAR BUILT BY SANFORD-DAY . . . This car shown at right is one of the S-D Automatic Bottom Dumping Cars built for U. S. Potash Co. for their Carlsbad Mine. We built these cars of one-half inch steel for heavy duty performance. The car represents another Sanford-Day development toward extending the life of cars in tough service, to increase haulage efficiency and reduce maintenance costs.

SALT CARS BUILT BY SANFORD-DAY . . . Shown at left are the S-D Automatic Bottom Dumping Mine Cars built by Sanford-Day for Leslie Salt Company many years ago. These cars, constructed of wood to handle salt, are still in operation. They are an example of the emphasis Sanford-Day places on the important details of construction to enable you to obtain more years of service from your cars.

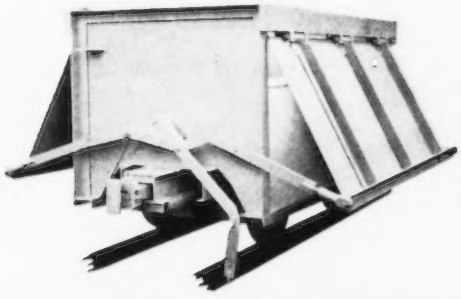
SANFORD-DAY IRON WORKS,

Market for mine cars!

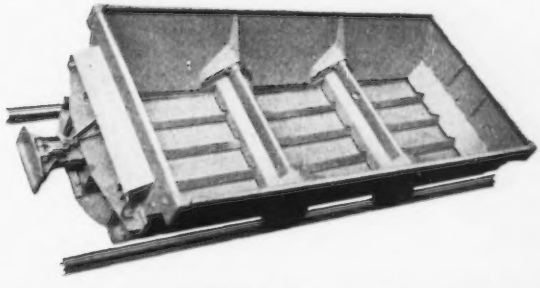
When you need mine cars you want cars built to meet your own requirements. Sanford-Day is your Super Market for mine cars.

We have listed above many of the various purposes for which we have built mine cars. The photos on these pages show a few of the many types of cars we have built for coal, metal and non-metallic mines.

Regardless whether you need one car or 101, don't hesitate to get one of our engineers into your mine with your officials—face to face with your problem. With this type of cooperation, plus our facilities and capacity to build any type mine car of any size, any haulage problem in your mine can be solved.



GABLE BOTTOM CAR BUILT BY SANFORD-DAY . . . We show above one of the 101 Sanford-Day Gable Bottom Cars being built for a customer in Nevada. The car features all-welded instead of riveted construction. It has smoother bottom, ends and sides for free flow of materials when dumping.



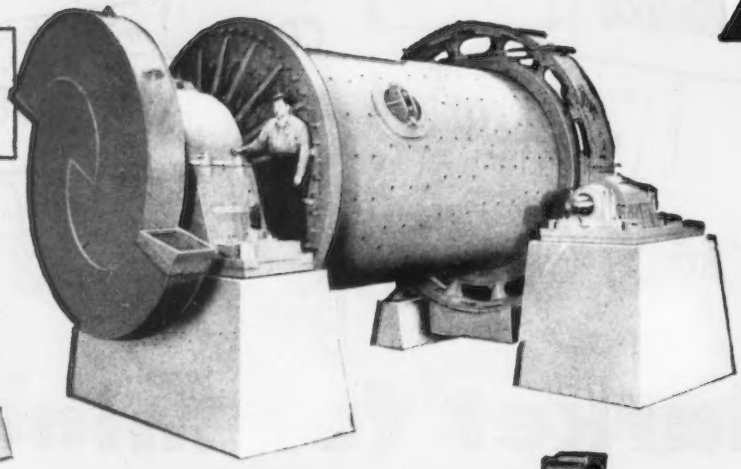
GYPSUM CAR BUILT BY SANFORD-DAY . . . Here is another S-D Automatic Bottom Dumping Car development for metal and non-metallic mines. This car is one of many specially built for Certain-Teed Products Corp. for hauling gypsum . . . hauling non-stop because S-D Automatics dump on the move. Extra heavy steel plates were used in the construction to absorb shock loads.

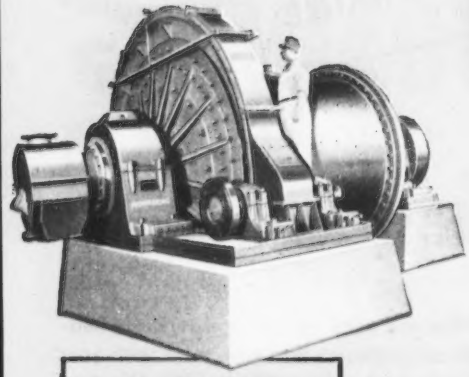
KNOXVILLE, TENN.

After 50 years of leadership in the industry, Sanford-Day still devotes its entire capacity to the production of mine cars. Most improvements in mine cars originate with this company.

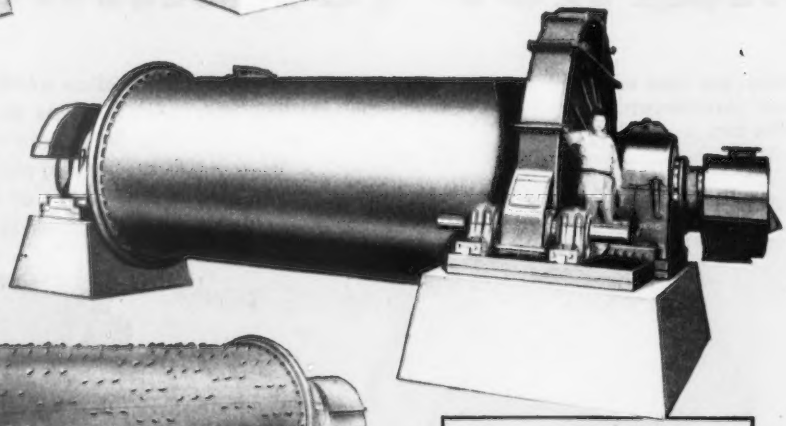
NORDBERG GRINDING MILLS

NORDBERG 10′-8″ x 17′ Wet Grinding Mill showing scoop feeder.

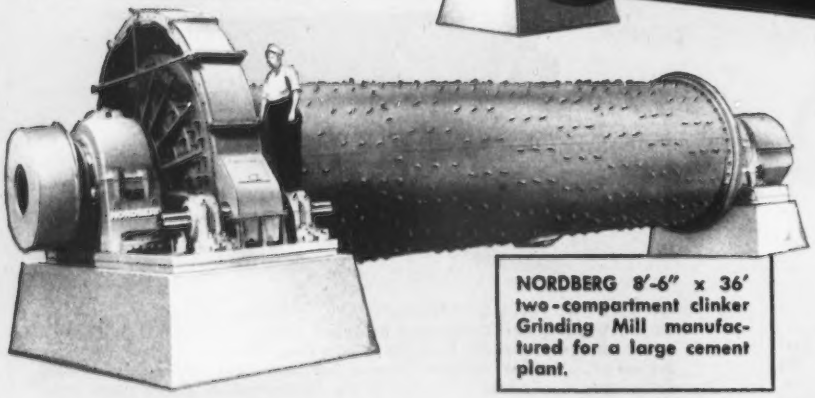




NORDBERG 9′-6″ diameter x 11′ long Dry Grinding Mill.



NORDBERG 9′-6″ x 24′ Wet Grinding Pebble Mill for non-ferrous milling.



NORDBERG 8′-6″ x 36′ two-compartment clinker Grinding Mill manufactured for a large cement plant.

NORDBERG MFG. CO.
Milwaukee, Wisconsin

SYMONS . . . A REGISTERED NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD.

M42

NORDBERG MACHINERY

NORDBERG

SYMONS CONES SCREENS NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON
TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG

for fast—low cost processing of Metallic and Non-metallic Ores, Minerals and Cement

MORE than half a century of progressive engineering achievement, combined with quality production in modern manufacturing facilities, have won for Nordberg a foremost position in the field of heavy machinery manufacture.

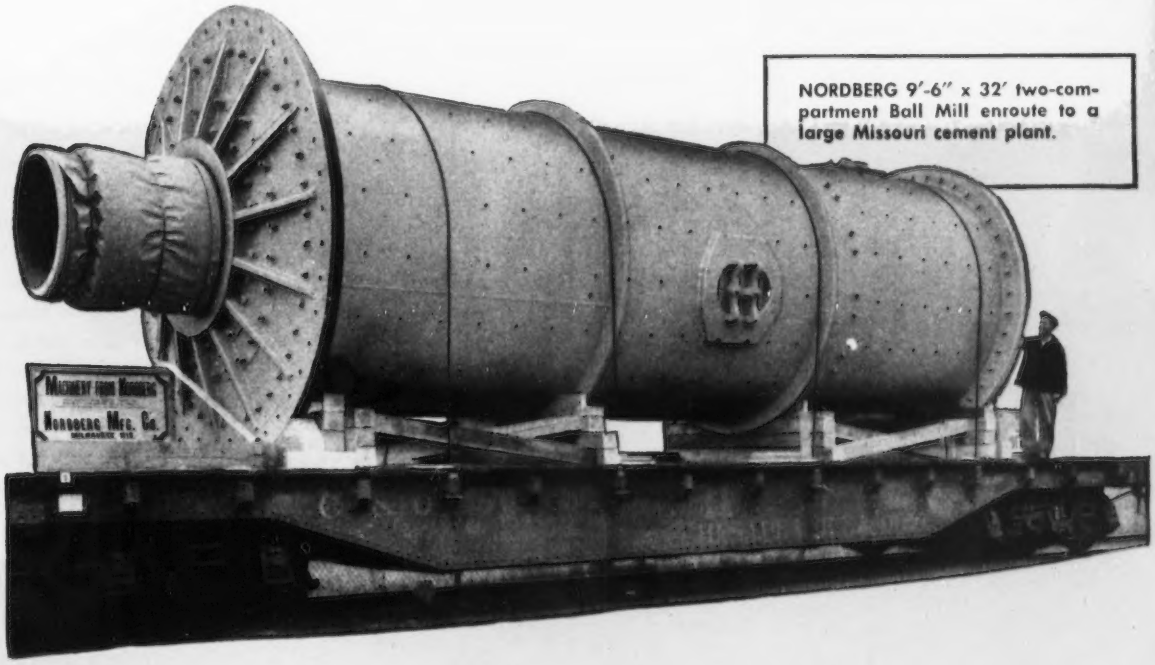
This is evidenced by the universal acceptance which Nordberg Machinery has received by most of the Mining and Mineral processing industries throughout the world.

Typical of this heavy machinery is the complete line of Nordberg Grinding Mills available for the manufacture of Cement, the extraction of Metals from Ores, and in the processing of Non-Metallic Minerals, which require comminution to fine sizes.

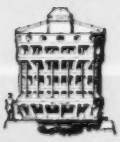
Nordberg manufactures Ball, Tube, Rod and Compartment Mills, of grate, overflow and peripheral discharge types for wet or dry grinding service, in sizes ranging to 13′-0″ diameter, and in lengths to 40′-0″

Competent engineering services are available for new processing plant design or modernization of existing plants.

For large or small operations, you can depend on Nordberg Machinery to deliver maximum output at lowest possible cost.



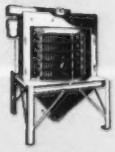
NORDBERG 9′-6″ x 32′ two-compartment Ball Mill enroute to a large Missouri cement plant.



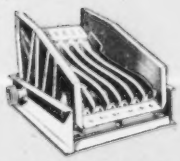
SYMONS GYRATORY CRUSHERS

SYMONS CONE CRUSHERS

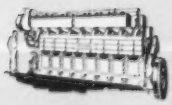
ROTARY KILNS and COOLERS



SYMONS "V" SCREENS



SYMONS VIBRATING GRIZZLIES and SCREENS



DIESEL ENGINES — 10 to over 10,000 hp.

Enough dust to stop 102 ordinary motors

Let just a pinch of these gritty particles inside a motor bearing and the result is always the same . . . bearing failure. The motor stops . . . production ceases.

Dust is busy ruining the bearings of ordinary motors all the time. Almost every time an ordinary motor is greased on the job, little powdery, abrasive specks are pumped into the bearing along with the grease.

Life-Line* motors lick this problem with sealed, pre-lubricated bearings. These bearings are packed with grease in dust-free rooms at the bearing manufacturer's plant. Then the bearing is completely sealed (not just shielded). The lubricant stays in . . . gritty dust stays out because you never have to grease a Life-Line motor.

Life-Line

The pre-lubricated bearing is one of the many features that make Life-Line motors the answer to lower operating and maintenance costs.

REMEMBER: The way to grease a *modern* motor is DON'T!

*Trade-Mark

J-21721

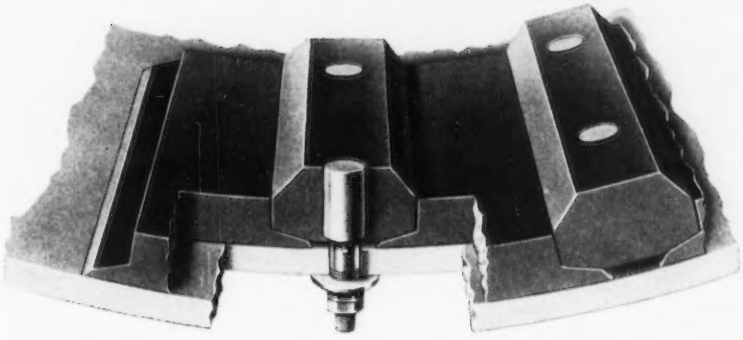
YOU CAN BE SURE... IF IT'S

Westinghouse

PHOTOMICROGRAPH OF INDUSTRIAL DUST, MAGNIFIED 100X. COURTESY CASE INSTITUTE OF TECHNOLOGY.

You can cut costs

in your grinding operation with U·S·S Lorain Rolled Plate Linings



- Linings are in easy-to-handle sections, accurate sizes to permit quicker installation
- Plates can be heat-treated to compensate for localized wear
- Correct sizes make tighter joints . . . eliminate shell wash
- Lift bars are designed for correct cascade action . . . height of lift varied according to conditions
- Bolt supports located near the bottom of the bar . . . last for life of the lining

● You can do more and better grinding, for less money, with U·S·S Lorain Rolled Plate Linings. The output of your mill increases when the usable diameter increases, and this is just what happens when rugged Lorain *rolled steel* plates are used instead of ordinary castings. Lorain Liners can be much thinner due to their superior strength. Their lighter weight simplifies handling.

You save money with U·S·S Lorain Rolled Plate Linings because they are readily installed and require less maintenance. The plates are accurately made and are in easy-to-handle sections for ready use. Severe localized wear at feed or discharge end of the mill can be balanced by heat-treating. Lorain Liners are so durable that they remain serviceable until they're almost paper thin. You benefit from the use of the entire plate . . . there is less waste, longer wear. Mill down-time will be reduced and so will your upkeep costs.

The accurate size of U·S·S Lorain Rolled Plate Linings assures tight fit between the ends of the plates and between plates and lift bars, eliminating shell wash.

U·S·S Lorain Rolled Plate Linings are available—in the diameter, length and thickness best suited to your operating conditions—through leading mill manufacturers whose names will be furnished upon request.

U·S·S GRINDING BALLS are carefully made of special composition steel to take long, rough wear evenly. Samples from each production lot are thoroughly tested to make sure of surface hardness and maximum hardness penetration. They come in eleven sizes from $\frac{3}{4}$" to 5". For further information just return the coupon below.

United States Steel Corporation
Room 2817-N, 525 William Penn Place
Pittsburgh 30, Pa.

Without obligation on my part, please send me your FREE booklet on U·S·S Grinding Balls.

Name .....

Company .....

Address .....

City ..... State .....

UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S LORAIN ROLLED PLATE LININGS AND U·S·S GRINDING BALLS

3-2023

UNITED STATES STEEL

NOBODY GUESSES

WHEN YOU USE...

WALSEAL®

When you see this fillet of alloy, **and the fitting is Walseal** you know that you have full penetration because the alloy comes from the inside.

Cutaway view of a Walseal Tee showing: 1 — **factory-inserted ring** of silver brazing alloy; 2 — fillet of silver brazing alloy that appears upon completion of Walseal joint; 3 — cutaway view of the completed joint showing that silver brazing alloy has flowed in **both** directions from the factory inserted ring.

When you join brass, copper, or copper-nickel pipelines with Walseal Valves, Fittings, or Flanges you know you have the *right amount* of the *correct type* of silver brazing alloy. The ring of Sil-Fos brazing alloy is *factory-inserted* in the ports of Walseal products at the time of manufacture.

No lost time or motion in handling the alloy . . . no difficulty in getting *full penetration* of the alloy regardless of the position of the valve or fitting . . . no guessing whether the joint is made right . . . the fillet of silver brazing alloy that shows up when the Walseal joint is completed, *comes from the inside!* And, whether you've made the joint yourself, or are inspecting the work of another, you know that if the silver alloy fillet is visible, *and the valve or fitting is Walseal*, you have full penetration. That's why nobody guesses when you use Walseal!

Walseal products are backed by the reputation of the Walworth Company, manufacturers of valves and pipe fittings since 1842.

For full information regarding silver brazed joints made with Walseal products, write for Circular 115.

SEE OUR CATALOG IN SWEET'S

Make it "a one-piece pipe line" with WALSEAL

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

Recommended for

Hot and Cold Water Circulating Systems

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DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

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with this ***NEW*** *Booklet You Can*

Choose the ***BEST*** *Mining Rope*

• This wire rope recommendation booklet in 8½" x 11" size, with large type, tells you the one best wire rope for each piece of mining equipment you operate. It shows big pictures which make it quick and easy to use.

The recommendations are based on the satisfactory results obtained from HAZARD wire ropes for years by mining operators all over the country. You can be sure of longer service life and lower operating costs when you use the HAZARD wire ropes this booklet recommends.

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Please send **DH-129-A** "Wire Rope Recommendations for Mining Industries."

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BROAD CRAWLER TREADS ENABLE G-E SHUTTLE CAR TO EASILY NEGOTIATE SOFT OR WET BOTTOMS, EVEN WHEN FULLY LOADED

New G-E Shuttle Car Proving Ideal for All Types of Mining Conditions

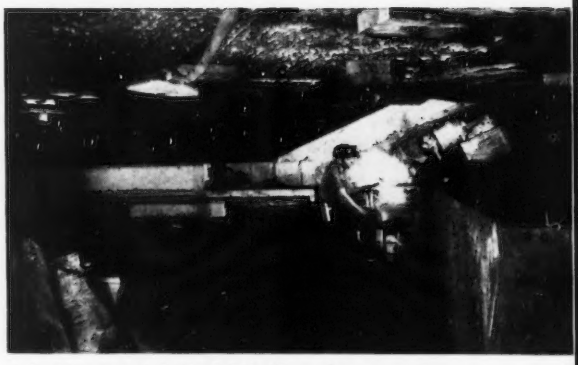
Low ground pressure, greater maneuverability, lower maintenance costs made possible with crawler treads

Using crawler treads instead of rubber-tired wheels, the new General Electric shuttle car is proving its efficiency and versatility under all types of mining conditions. Fully loaded, the car has only 20 pounds per square inch ground pressure. With a 14 to 16 foot turning radius, the car is ideal for operation where tunnels are narrow and turns are sharp. The wide conveyor, which is made possible by the use of crawler treads and the absence of wheel-wells, increases carrying capacity up to 300 cubic feet (with 12-inch sideboards).

The G-E shuttle car is simplicity itself in design and ease of operation. All motors and controls, though well-protected from abrasive materials and meeting U.S. Bureau of Mines' specifications, are easily accessible for servicing and maintenance.

Whatever mining conditions you face—no matter how rigorous they are—the new G-E cable-reel track-laying shuttle car can meet your requirements of service and economy. For complete information contact your nearest G-E sales office. General Electric Company Schenectady 5, New York. 120-65

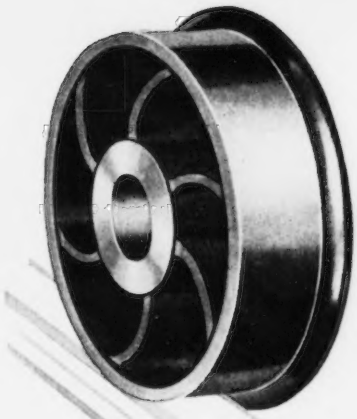
1878 75 1953 YEARS OF ELECTRICAL PROGRESS



Only 42 inches high, the G-E shuttle car has a carrying capacity 30 per cent greater than cars of conventional design. Car above, at Jamison Coal and Coke Co., Hostetter, Pa., shows simplicity of unloading in tight quarters.

You can put your confidence in—

GENERAL ELECTRIC



ore cars really keep rolling on AMSCO

manganese steel wheels

five years continuous service without replacement

Five years ago a mining company equipped thirty ten-ton ore cars with Amsco Manganese Steel wheels. Not one has had to be replaced because of wear or breakage! Here is why Amsco products made of Manganese Steel, "the toughest steel known," lasts:

1 Work-hardens under impact to as high as 450-550 Brinell.

2 Surface polishes to reduce wear and minimize lubrication.

3 12 to 14 percent Manganese for strength and ductility.

and it's easily weldable with Amsco Hardfacing Alloys

Write Amsco or ask your ore car builder for information on how Amsco Manganese Steel wheels can help you keep production rolling.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION

376 East 14th Street · Chicago Heights, Ill. OTHER PLANTS: NEW CASTLE, DEL., DENVER, OAKLAND, CAL., LOS ANGELES, ST. LOUIS. IN CANADA: JOLIETTE STEEL DIVISION, JOLIETTE, QUE. AMSCO WELDING PRODUCTS DISTRIBUTED IN CANADA BY CANADIAN LIQUID AIR CO., LTD.

"For branch lines I use a half-hitch—pulled up tight

"The detonating wave travels along the Primacord at about four miles per second. At that speed it must pass from the trunk line into each branch 'down-hole' line, where it detonates the charges.

"You can see why these branch connections are important—why they all have to be *tight* and at right angles to the trunk line. And that's where textile-covered Primacord has a big advantage. You can easily make these branch line connections with simple half hitch knots that can be drawn up tight and will stay that way."

Ask your explosives supplier or write for further facts to

THE ENSIGN-BICKFORD COMPANY
Simsbury, Connecticut
Also Safety Fuse Since 1836

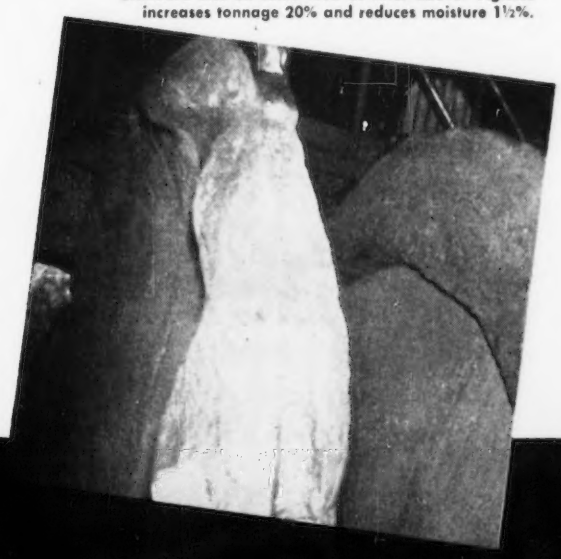
Reinforced Primacord (for deep holes and resistance to abrasion) connects with the **Plain Primacord** trunk line with a simple half hitch, pulled up tight. The textile covering grips securely.

Use the brand of Primacord that meets your needs exactly. In addition to those mentioned, there are: **Wire Countered Primacord,** for deep, ragged holes; and **Plastic Reinforced Primacord,** for deep holes and unusual wet conditions.

Use PRIMACORD®

The PROVED and APPROVED DETONATING FUSE

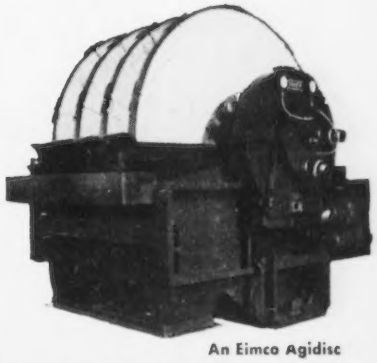
Above: Agidisc filtering copper concentrate. Below: Standard disc on same feed as filter above. Agidisc increases tonnage 20% and reduces moisture 1½%.



The Eimco Agidisc Filter for Continuous Vacuum Filtration of Metallurgical Slurries

These photographs show some of the important exclusive features offered in the Eimco Agidisc. Smooth, even, uniform cake formation in the two upper pictures which contrast with the typical standard disc filter with the heavy, lumpy build up of cake in the outside ring of the disc. (shown lower left.) The Agidisc with its uniformity of cake deposit, will make possible in your filtering station, higher capacity, lower moisture and longer bag life.

Our pilot plant will gladly run tests on your material and recommend size and type of filter to give you the best results. Write for information.



An Eimco Agidisc

EIMCO

AH77

THE EIMCO CORPORATION

The World's Leading Manufacturer of Vacuum Filtration Equipment

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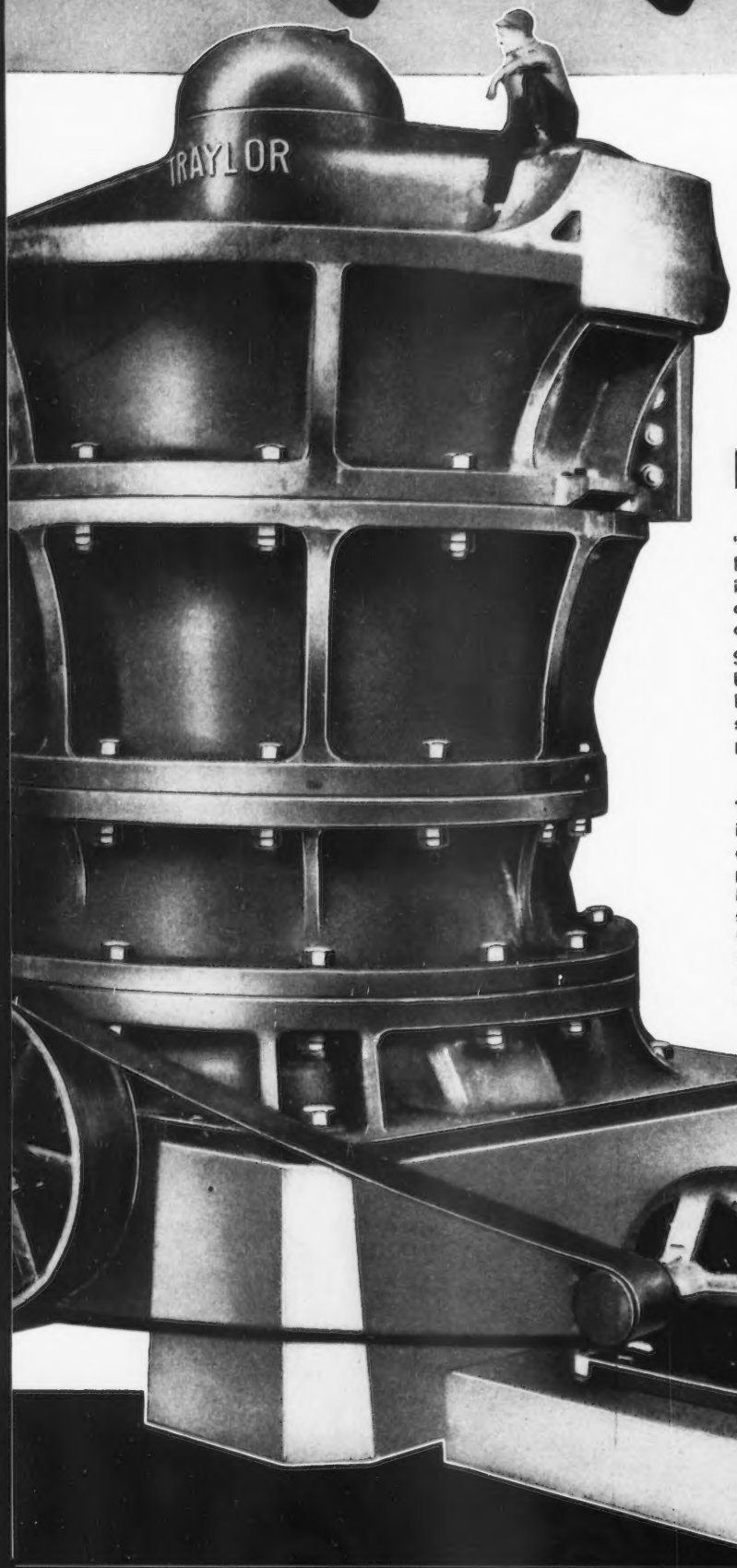
BIG Gyratory Crushers



THE 6th 60" GYRATORY BUILT BY TRAYLOR

"Traylored" to produce 30,000 tons per day, the latest of Traylor's super-size 60" Gyratory Crushers is on its way to the famous copper mine at Chuquicamata, Chile. This crusher is equipped with Traylor's original curved concaves and bell head.

Some idea of the weight of this gigantic machine can be judged from the relatively small eyebolt used to lift the shaft. It weighs over half a ton. The cast steel frame of the crusher is over 5" thick at several points.

Traylor built the first successful 60" Gyratory in 1919 . . . 34 years ago. It proved that a gigantic crusher with high hourly capacity could effect amazing production economies. This first 60" was sold to a Michigan limestone producer. Because of its outstanding efficiency, this same customer purchased their second 60" Traylor Gyratory four years later. Of these 60" crushers, three are in Michigan, one in Arizona, one in England and one in Chile. Capacities up to 3500 tons per hour.

A Traylor LEADS TO GREATER PROFITS

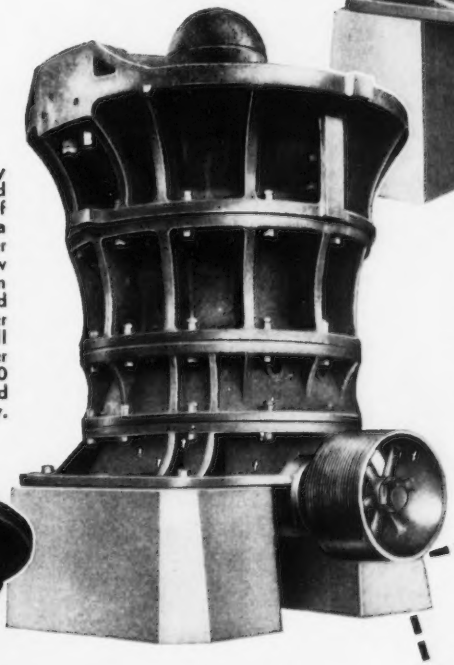
Since 1919

are "Traylor-MADE"

Result: Traylor has acquired special skills and facilities for building these big machines.

With 38 of these huge Gyratory Crushers in the field, Traylor design and construction have been proved under a wide range of operating conditions. To match this accumulated "know-how," Traylor has expanded facilities to build these big crushers with precision and efficiency. Consequently, the producer who needs 645 to 3500 tons hourly production will find the Traylor TC a crusher of unusual operating economy and dependability. Write concerning your requirements. Let us show why it pays in the long run to buy a Gyratory "Traylored" to your individual needs.

EIGHT 54" Traylor Gyratory Crushers are in the field; four in Canada, one in England, one in Mexico, one in Michigan and one in Nevada. These crushers are used to help produce cement, nickel, copper and iron. The Traylor 54" Gyratory has hourly capacities from 1400 to 2240 tons.



FOUR 48" Traylor Gyratory Crushers have been built and TWO are in the works. Of those in the field, one is in a Pennsylvania ore mine, another is crushing trap rock in New Jersey, still another is in Minnesota on iron ore and the fourth in Nevada on copper ore. The two in the works will be crushing iron ore and copper ore. Capacities up to 1980 tons per hour are obtained with the 48" Traylor Gyratory.

EIGHTEEN 42" Traylor Gyratory Crushers are in a wide range of service. One is in Chile, two in Canada and the rest dispersed over 14 different states. The 42" Traylor Gyratory provides capacities up to 1290 tons per hour.

FOR MORE INFORMATION
mail this coupon today to . . .

TRAYLOR ENGINEERING & MANUFACTURING CO.
1542 MILL ST., ALLENTOWN, PA.

Send me complete facts about the Traylor TC Gyratory.

Name: _____

Position: _____ State: _____

Company: _____

Address: _____

Sales Offices: New York • Chicago • San Francisco
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P.Q.

Traylor has built 38 of the world's biggest crushers

Map shows the Cachuma Reservoir which will be formed by damming the Santa Ynez River. Crest of the mountain range is shown in center. South Coast Conduit will take water from Pacific end of tunnel to distribution centers.

6½-mile tunnel to bring water to thirsty Santa Barbara area

Because of a mountain barrier the Santa Ynez River in Southern California flows away from population centers, emptying each year its millions of gallons of water virtually unused into the Pacific. Meanwhile, the nearby Santa Barbara area, on the southern side of the Santa Ynez range, is suffering a water shortage.

To divert Santa Ynez water to where it is so urgently needed, the 6½-mile Tecolote Tunnel is being bored through the mountain, to tap water from a reservoir formed by the recently completed Cachuma Dam.

Begun in 1950, work on the tunnel has been pushed ahead through extremely tough strata despite frequent delays caused by subterranean water at the tunnel face.

Halverson Contractors, a combination of H. Halverson of Spokane and Carl M. Halverson of Portland, hold a $7 million contract with the U. S. Bureau of Reclamation for this project. Using both carbide-insert bits and single-use bits on rods of Bethlehem hollow drill steel, the contractors have advanced through a sedimentary formation, including some unusually tough shales and sandstones.

As in so many projects where drilling speed is a dominant factor, Bethlehem hollow drill steel has played a part in helping to keep Tecolote Tunnel drilling on schedule.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

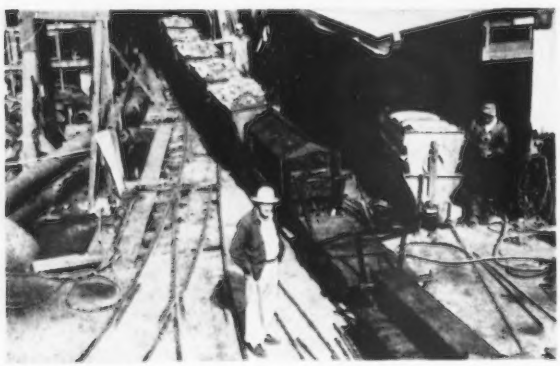
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

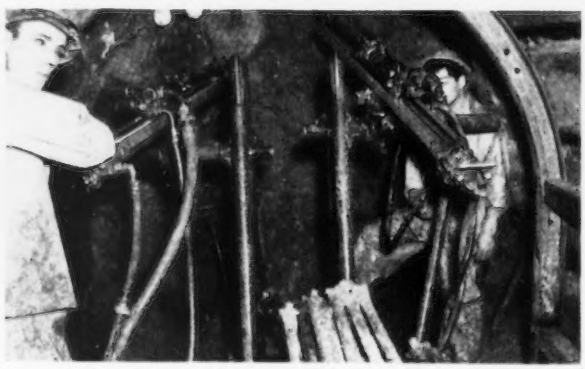
Two Grades of

BETHLEHEM HOLLOW DRILL STEEL

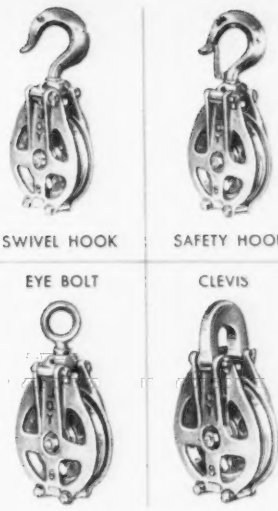
- THE "OLD RELIABLE" CARBON TYPE
- ULTRA-ALLOY, OUR CHROME-MOLY GRADE



Tunnel Superintendent Oscar Peterson stands in foreground at the Pacific portal of Tecolote Tunnel as a trainload of muck emerges. The crews have advanced through a sedimentary formation unusually tough to penetrate and have blasted more than 80,000 cu yd.



The 7-ft-diam horseshoe bore is drilled with 6-ft rounds, every third round preceded by 30-in. test holes. Shown at tunnel face is a standard drill jumbo which mounts 3½-in. drifters. Halverson Contractors uses both carbide-insert and single-use bits on rods of Bethlehem Hollow.



HERE'S HOW THEY'LL SIMPLIFY YOUR SCRAPING JOB

Joy Tail Rope Sheave Blocks were developed *in the mines,* by mining men—specifically for the rugged job of scraper loading.

Every design detail has been thrashed out, in service, to give real "bug-free" operation. For example:

- Extra wide sheave wheels reduce rope wear.
- Quick-opening snatch blocks allow fast, easy rope changes.
- Large throat openings and flared side plates will actually pass knots tied in *wire rope.*
- Sealed-for-life bearings are watertight, dust-tight, and require *no lubrication.*
- Tough alloy steel is used for side covers, wheels, hooks, eyelets and clevises.
- All steel construction—can be picked up by magnets if lost in a load.

A Joy Sheave Block is a stout, durable piece of equipment that requires practically *no attention.* It's just the ticket for hard-to-reach-to-service jobs. ● Get the full story today—write for Bulletin 76-D. **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

QUICK-OPENING SNATCH BLOCK CONSTRUCTION

Opened block showing milled slot. Pin removed.

Block closed, pin in place, locking key in "Open" position.

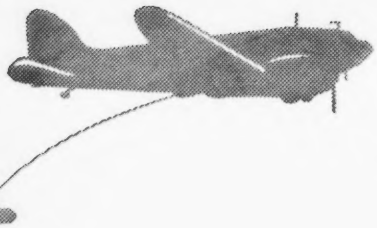
Block closed, pin in place, key in "locked" position.

JOY

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT

WBD MAGEE

WHAT IS THE DIFFERENCE IN MAGNETOMETER SURVEYS?



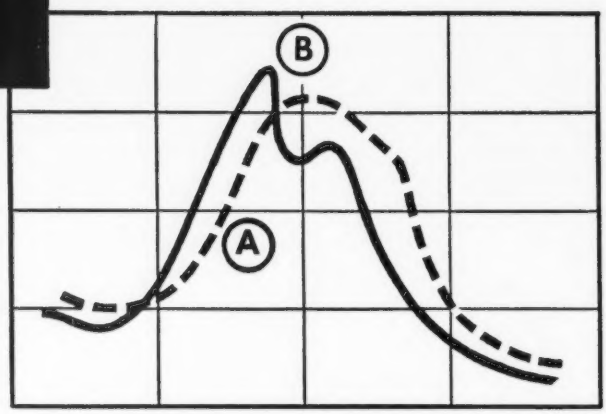
The basic accuracy of any airborne magnetometer survey depends first on the record. Only with a complete, exact magnetic record can you make a valid appraisal of an ore body's size, shape and depth.

Since most magnetometer surveys are flown at 150 to 200 ft. per second, you must have split-second response from the magnetometer. Otherwise, you get a rounded-off, mushy record. To get a significant, complex figure, the recorder must be able to sweep rapidly over a range of thousands of gamma.

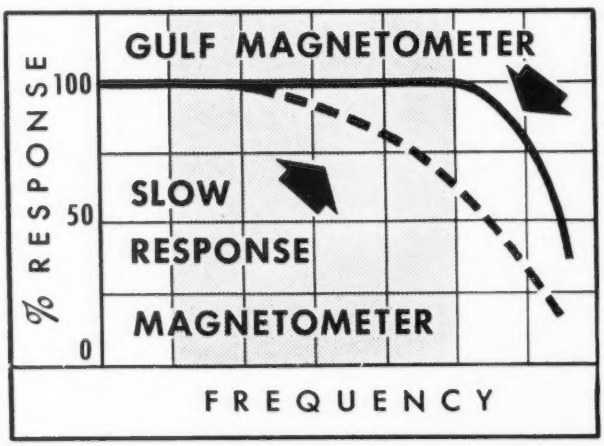
Characteristics of the airborne magnetometer can be expressed simply in a response curve, as shown in the chart at the lower right. Important components of signals found in most mineral surveys fall within the shaded area. Some magnetometers fall off badly here in their response to rapid changes of field. But even in higher frequency ranges, the Gulf Magnetometer's response has great fidelity. With the Gulf Magnetometer, AERO delivers the full record—no mushing or diluting. And sweeping shifts in magnetic intensity are often guideposts to important new finds.

The pay-off difference in AERO's magnetic surveys was proved at Allard Lake, at Morgantown, and at other new finds of magnetite, asbestos, ilmenite, chrome, and other minerals.

You're mapping for the complete record. Why not get it – with AERO's 500,000 miles of aerial exploration experience?



A slow response magnetometer produces a mushy, inadequate record, as in Curve A. The high sensitivity Gulf Magnetometer delivers a full, significant record, as in Curve B.



Some magnetometers fall off in response within important frequency ranges. The Gulf Magnetometer maintains fidelity throughout.

AERO
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PHILADELPHIA 20, PENNSYLVANIA
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AIRBORNE MAGNETOMETER SURVEYS
PLANIMETRIC MAPS
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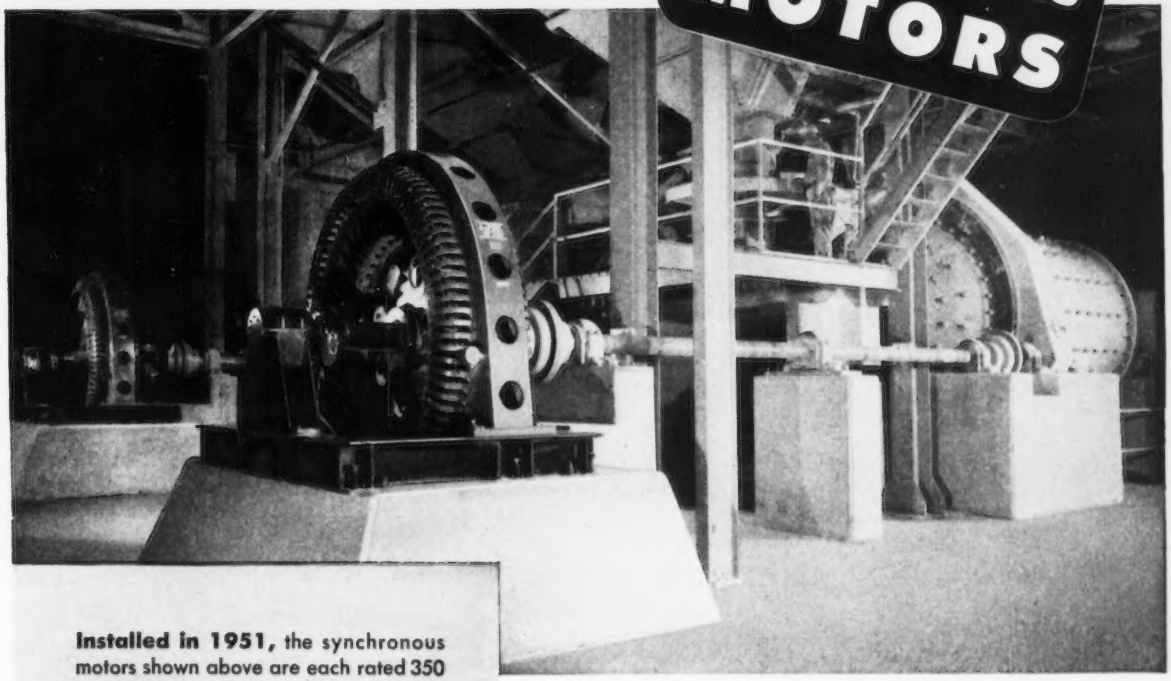
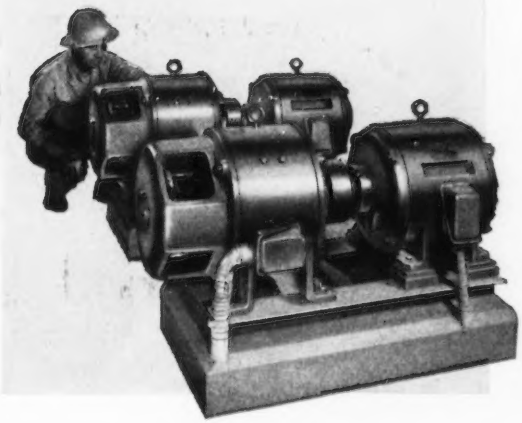
Built for a Long Grind

ALLIS-CHALMERS
Synchronous
MOTORS



Installed in 1951, the synchronous motors shown above are each rated 350 hp, 80% pf, 440 volts, 180 rpm.

The 8 by 12-ft ball mills were furnished by Allis-Chalmers, along with the 15-kw m-g sets (shown below) which supply the excitation for the grinding mill motors.



Here are three reasons why Allis-Chalmers grinding mill motors help keep your mills grinding economically year after year:

Each motor is engineered for its job. A-C's half century of experience building electrical equipment *and* processing machinery assures torque and other operating characteristics tailored to the individual installation requirements.

Time-proved basic design features contribute to long life and trouble-free operation. These are described in detail in Bulletin 05B7648.

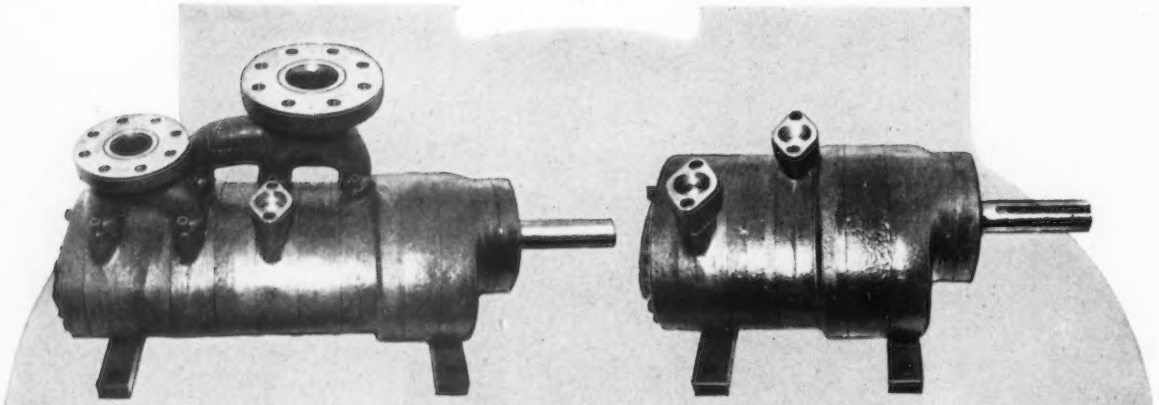
Adequate manufacturing, inspection and testing facilities insure that each motor will be built exactly as specified.

For more information on motors that minimize maintenance and down time, call in your A-C representative, or write for illustrated Bulletin 05B7648. Allis-Chalmers, Milwaukee 1, Wisconsin. A-4150

ALLIS-CHALMERS

Now—a BERRY *Rotodraulic* (TRADE MARK) unit

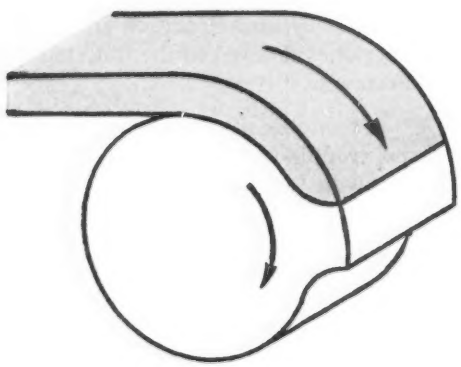
New, rugged 32-10 series pumps and motors have

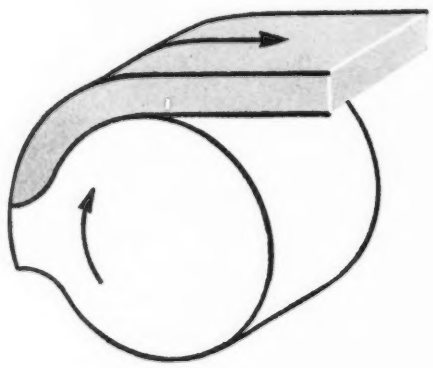


Unit shown above, Model 32-10 E3, is rated for 1000 psi continuous service. As pump, displacement is 180 GPM at 1200 RPM. As fluid motor, unit is rated up to 300 horsepower at 2800 RPM.

Model 32-10 D1 above displaces 60 GPM at 475 RPM as a pump. It is designed for 1000 psi continuous duty. Intermittent service up to 1500 psi is permissible. As a fluid motor, this unit is rated up to 100 horsepower at 1087 RPM, and 6300 lb. ins. of torque.

Multi-cylinder Berry units offer the advantages of common suctions and separate discharges. Each cylinder thus can discharge to different services and different pressure. The 32-10 E3 shown here has a common suction manifold with two cylinders discharging to one line and one cylinder discharging alone.





Motors Positive torque at all speeds down to zero is assured by the force of the liquid column under pressure acting on the torque arm of the rotary piston.

Pumps Positive displacement of the oil is assured as the unique Berry rotating piston sweeps its cylinder arc in every revolution — ***pushing*** the liquid column before it at the pressure required.

for your *biggest* hydraulic job!

unlimited applications, capacities up to 300 h.p.

Now ready to take on your heaviest assignment is the same revolutionary Berry rotating piston that has proved so successful in many industrial and petroleum field jobs.

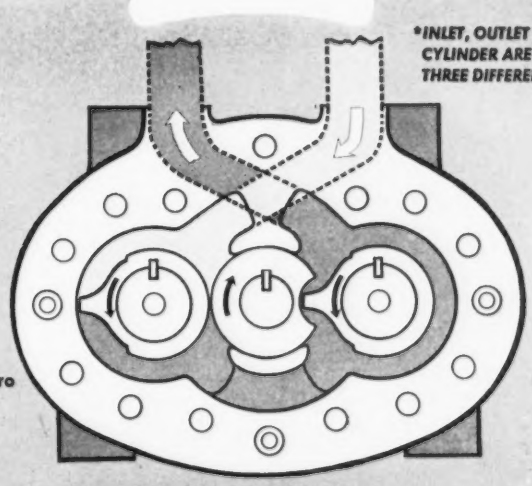
Industrial applications include saw-mills, machine tools, liquid fuel transports, draw-benches, drop forges, harvesting machines, extrusion presses, metal-working machines and many more.

In the oil fields, Berry units are powering vibrating screens, water pumps, mud mixers, wire measuring reels, bug blowers, pipe-wrapping machines and shot-hole drilling rigs.

Interchangeable as pumps or fluid motors and designed for overhung loads, Berry units are rugged, shock resistant, dependable, positive, economical, long-lived. Write us for full details or call your local distributor.

A few suggested uses for Berry 32-10 Units:

• Steam Shovel Conversions • Winches • Hoists • Drag Lines • Earth-Moving Equipment • Drilling Rig Rotary Tables • Mining Machinery • Steel Mill Machinery • Large Saw Mills.



Pressures:
to 1000 psi continuous
to 1500 psi intermittent

Speeds:
motors — 2800 RPM down to zero
pumps — up to 1200 RPM

Ratings:
to 300 horsepower

Displacements:
motors — 138, 276, 414 GPM
pumps — 60, 120, 180 GPM

Torques **— to 21,000 lb. ins.**

Only the BERRY design gives you all these:

Positive Torque	Positive Displacement
Low Noise Level	Relatively Pulsationless
Variable Speed	Instantaneous Reversibility
Long Life	Rugged Dependability
Overload Protection	Explosion-Proof Safety
Series and Parallel Operation	Motor-Pump Interchangeability

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ROTARY POWER

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Dustless BLENDERS

Produce Perfectly Mixed Products with NO Loss of Materials

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The ingredients to be mixed enter the mixing chamber of the drum through a chute. Note scoops which carry up and dump the ingredients as the drum rotates.

DISCHARGING

By simply throwing a lever, the inlet is closed and the mixer is in discharging position. The completely mixed materials drop off the lifting scoops and discharge through chute without segregation of ingredients

Four-way mixing action produces homogeneous blends. No matter what the densities, weights, finenesses or other physical properties of the ingredients, Sturtevant Dustless Blenders provide *a thoroughly blended product* with no substances floating to remain unmixed. Sturtevant advantages include—single opening for both receiving and discharging . . . "open door" accessibility for quick, thorough cleaning . . . rugged construction for long life and minimum maintenance. Sturtevant Dustless Blenders are available in mixing capacities from 500 to 20,000 pounds. Write for information or engineering assistance.

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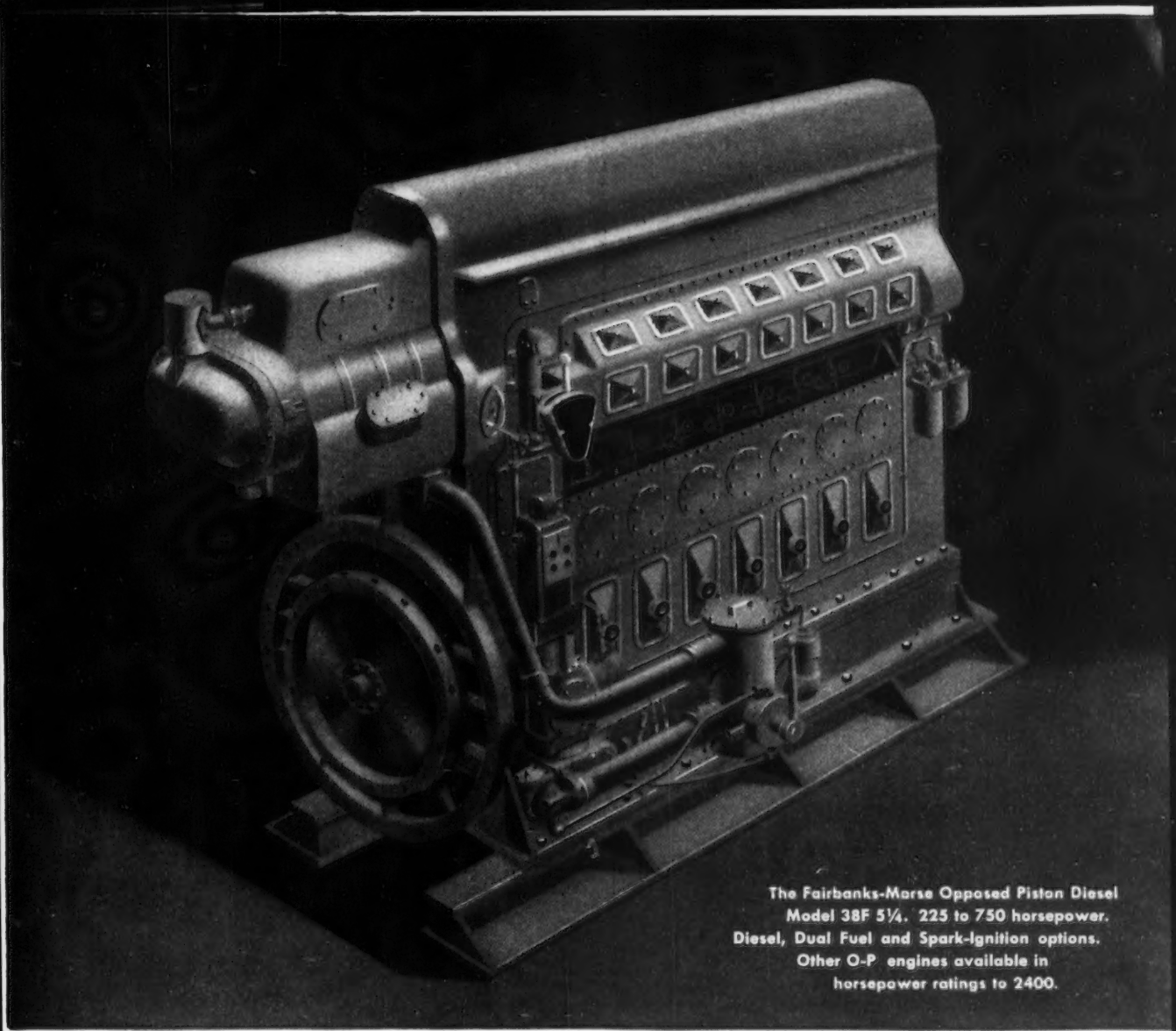

The Fairbanks-Morse Opposed Piston Diesel
Model 38F 5¼. 225 to 750 horsepower.
Diesel, Dual Fuel and Spark-Ignition options.
Other O-P engines available in
horsepower ratings to 2400.

...always a need for something *Finer*

It was designed and built without thought of price... built only to give the maximum of heavy-duty horsepower in a minimum of space... plus an unvarying reliability upon which you could stake a balance sheet of operating costs and profits.

The price?

Not quite as low as conventionally designed and conventionally manufactured engines, but low enough to insure that no one who wants and needs an engine which gives more, need forego its ownership. For the more difficult tasks of producing power, this engine is a fulfilling answer.

Fairbanks, Morse & Co., Chicago 5, Illinois.

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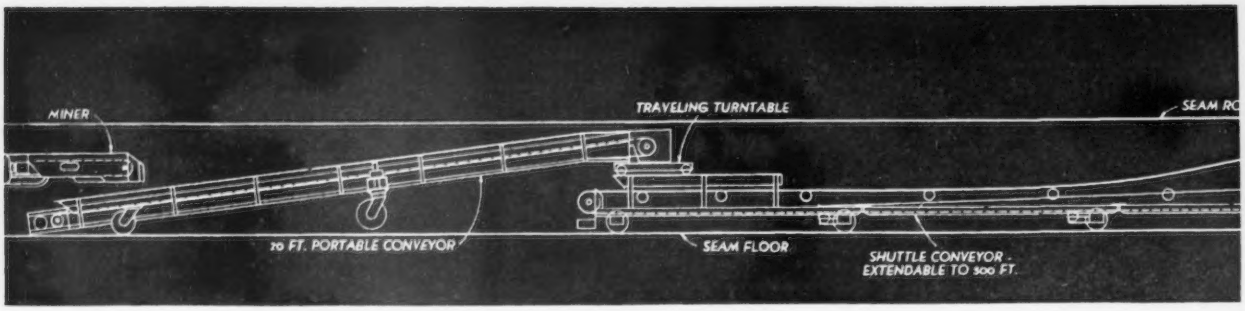
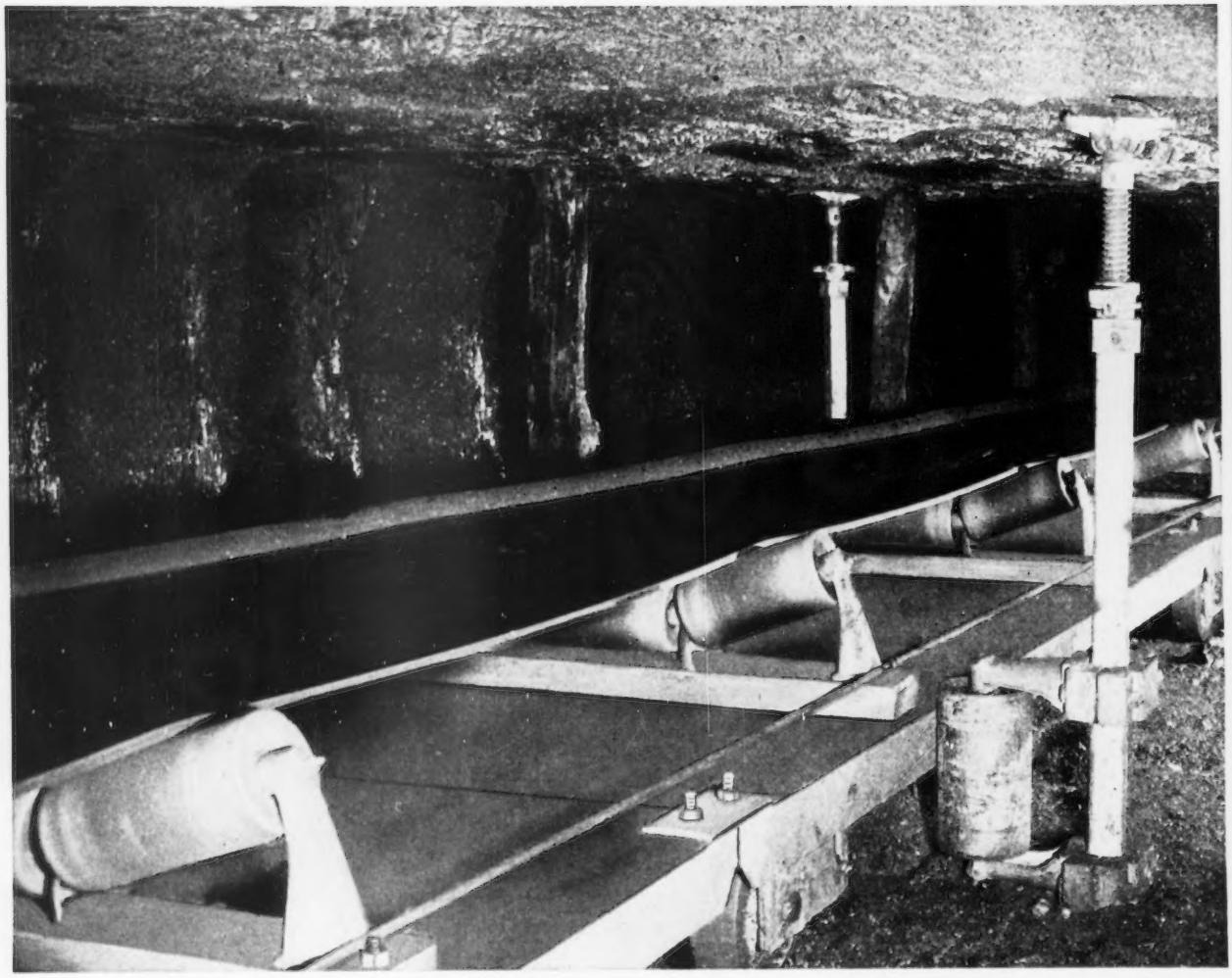


Here's the New Answer to



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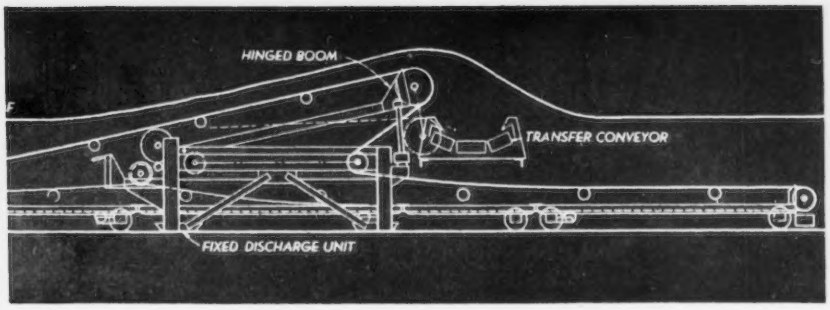
HEWITT-ROBINS

EXECUTIVE OFFICES, STAMFORD, CONNECTICUT



Continuous Mining

It's The Hewitt-Robins Mine Type Shuttle Conveyor With Fixed Tripper

The Hewitt-Robins Mine Type Shuttle Conveyor with fixed tripper forms the final link in a complete belt conveyor system that can handle an uninterrupted flow of ore directly from the face to the surface as fast as any mechanism can produce it.

This versatile unit is the key to truly continuous mining. The Shuttle Conveyor is both extendable and retractable —can follow the progress of mining and at the same time maintain a fixed transfer point through a fixed tripper and is extendable to 600 or 700 feet.

As the working face advances, the Shuttle Conveyor can closely follow the mining machine and receive its load either directly or from an intermediate transportation unit such as shuttle car or loading machine. The Shuttle Conveyor is so designed that alignment can be properly maintained by mounting small guide rollers on standard roof-jacks along each side of the conveyor frame, when operating off-track. When track-mounted, the guides are not required.

Remember, when it comes to any type of belt conveyor or complete belt conveyor systems, only one company—Hewitt-Robins—can assume single and unified responsibility for successful operation. For only Hewitt-Robins designs, engineers, manufactures and installs both the belt and machinery.

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*For immediate information about these industrial rubber products, call your Hewitt Rubber Distributor (See "Rubber Products," Classified Phone Book.)

Hewitt-Robins Incorporated
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TITLE & COMPANY

STREET ADDRESS

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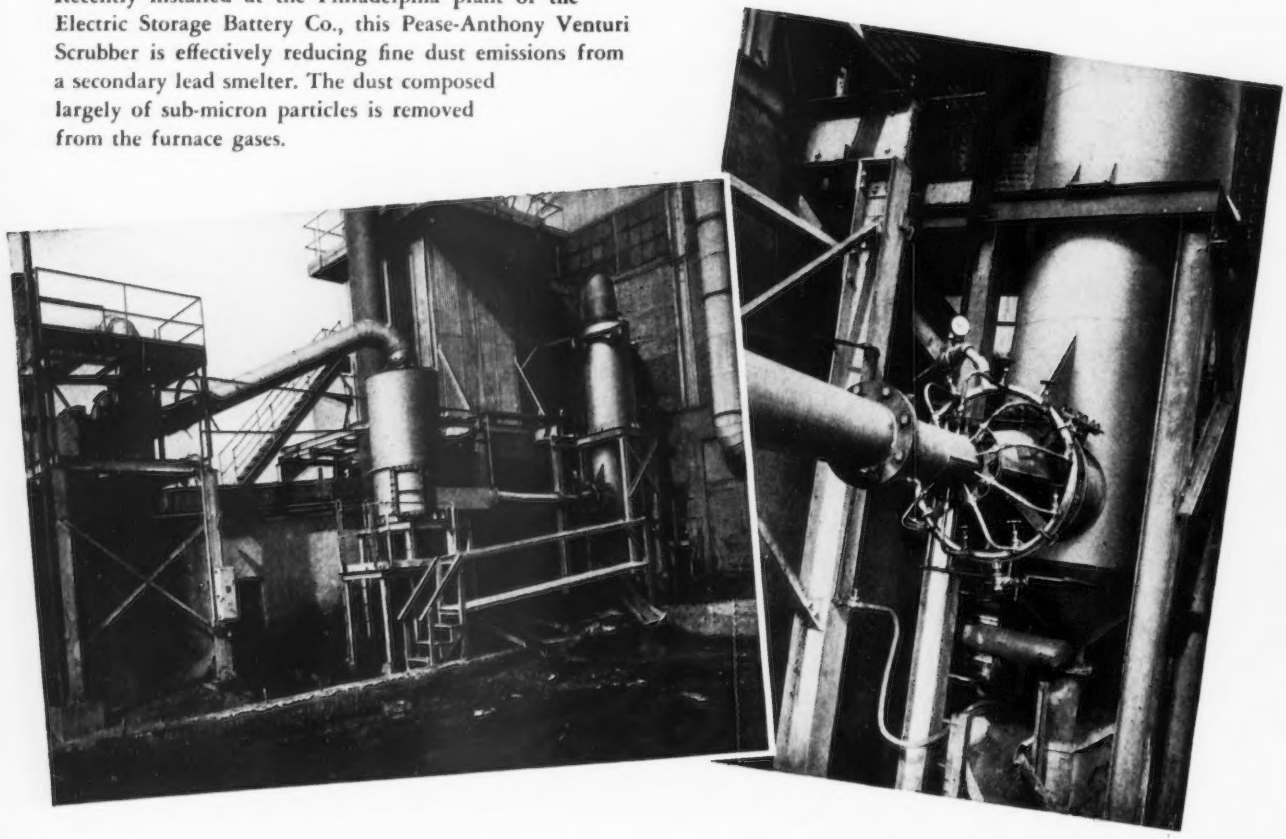
Here's Efficient DUST and FUME Removal

Recently installed at the Philadelphia plant of the Electric Storage Battery Co., this Pease-Anthony Venturi Scrubber is effectively reducing fine dust emissions from a secondary lead smelter. The dust composed largely of sub-micron particles is removed from the furnace gases.



Other Typical Applications

Chemico P-A Venturi Scrubbers are now being used in a wide range of industries for the highly efficient removal of micron and sub-micron dusts and fumes. For a detailed analysis of your scrubbing problem, write or call our P-A Sales Department.

APPLICATION	MATERIALS BEING REMOVED	DUST AND FUME LOADINGS Inlet to Scrubber	Outlet from Scrubber
DUSTS			
Diatomaceous Earth Plant	Diatomaceous Earth	1.2 grains/scf	0.05 grains/scf
Rubber Blenders	Carbon Black	0.3 grains/scf	0.003 grains/scf
Yellow Brass Foundry Furnace	Zinc Oxide	3.5-10 grains/scf	0.7 grains/scf
Lime Kilns	Lime and Na_2O Fumes	7.0 grains/scf	0.02 grains/scf
Electric Furnace Fumes	Iron Oxide	0.2 grains/scf	0.03 grains/scf
Blast Furnace	Iron Oxide	4.0-20.0 grains/scf	0.008-0.08 grains/scf
Secondary Lead Blast Furnace	Lead and Rubber Compounds	1-10 grains/scf	0.05-0.20 grains/scf
FUMES			
Copperas Roasting Plant	H_2SO_4 Mist	100-300 Mg/scf	1-5 Mg/scf
Titanium Plant	H_2SO_4 Mist	120 Mg/scf	2.0 Mg/scf
Phosphoric Acid Plant	H_3PO_4 Mist	100-300 Mg/scf	3.0 Mg/scf
Wood Distillation	Tar Fog and Acetic Acid Mist	1000 Mg/scf	10-40 Mg/scf
Enamel Smelting Furnace	Dust and Fluoride Fumes	55.0 Mg/scf	4.0 Mg/scf
Dry Ice Plant	Amine Fog	25.0 Mg/scf	5.0 Mg/scf

Phone (MU 8-2370) or write our P-A Sales Dept. for further information and ask for our Bulletin M-102 on P-A Gas Scrubbers.

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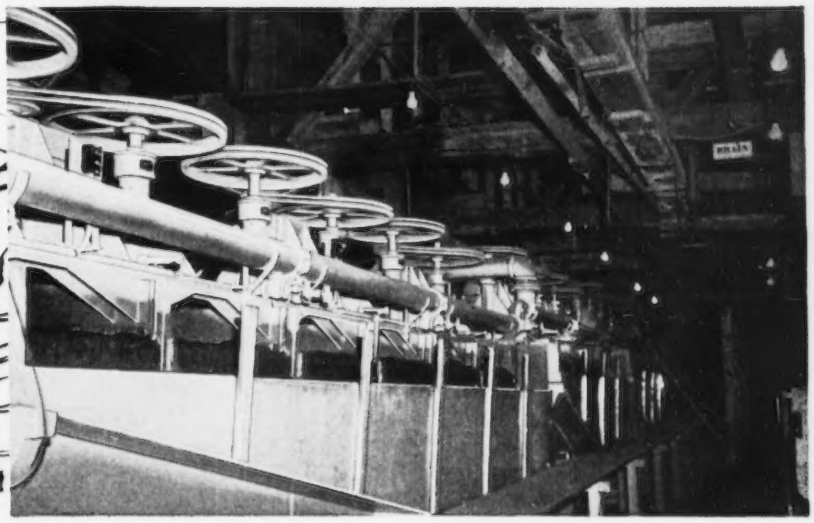
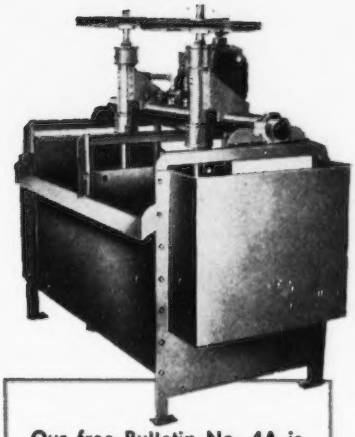
Victory again at... BUNKER HILL



AGITAIR® is there!



Our free Bulletin No. 4A is a graphic and comprehensive description of Agitair Flotation. Write for your copy today.

This Bunker Hill is at Kellogg, Idaho. And the tactical problem concerns successful metallurgy. It was a wise generalship that chose Agitair Machines for the rougher and cleaning circuits in the 2000-ton flotation section of Bunker Hill mill — treating zinc, lead and silver ores. For roughing, 48-inch machines are used; for cleaning, 36-inch machines.

Judged by the company it keeps, Agitair is an important factor in most of the great metal mining regions of the world. Galigher engineering service adapts this true flotation method to a wide range of metals and mill capacities. Agitair is flexible in application, rugged in use, successful in results.

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Iron ore..

...pumping at lower cost per ton

Pumping costs can be lowered and production increased with highly efficient Wilfley Sand Pumps. Wilfley Sand Pumps have earned a reputation for making actual dollar savings in operating and maintenance costs. These famous pumps operate continuously, without attention, on 24-hour schedules. Individual engineering on every application. Write, wire for complete details.

- *Cost-saving efficiency*
- *Stepped-up production*
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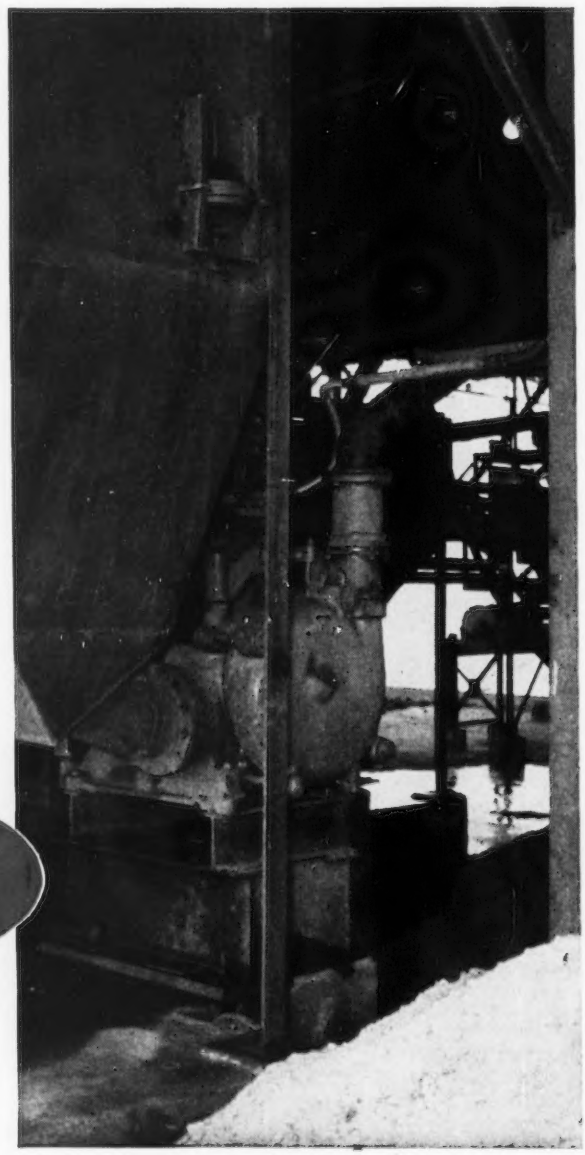
- *Minimum replacement of parts*
- *Designed for simple installation*
- *Economical pump size for every pumping requirement*

Companion to the Famous WILFLEY Acid Pump



WILFLEY
centrifugal PUMPS

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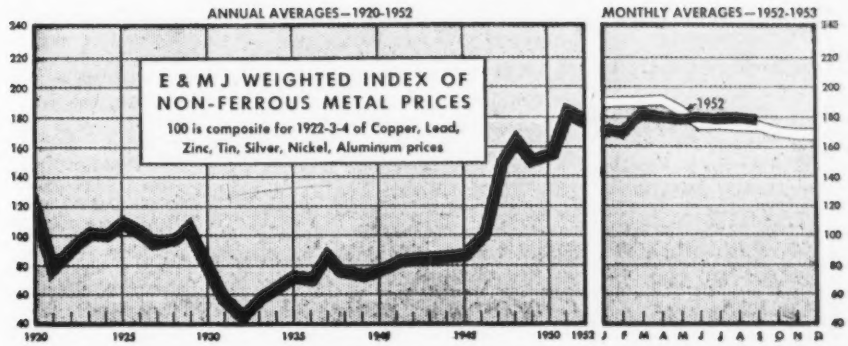
E&MJ OUTLOOK

PRICES


ANNUAL AVERAGES—1920-1952
MONTHLY AVERAGES—1952-1953
E & M J WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is composite for 1922-3-4 of Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum prices
1952

MARKETS

Inventory reduction seems uppermost in the minds of consumers of non-ferrous metals. One short-memoried company, for example, hopes to keep metal inventories to a two-week level. Cautious buying results.

To cut costs, manufacturers continue pounding out finished products. Filled pipelines and eventual cutbacks must inevitably result.

Lower monthly averages for lead and zinc pulled the *E&MJ* index of non-ferrous metal prices to 181.10 for September from August's 182.70.

Domestic zinc is back on the East St. Louis basis. Difficulties with ore contracts and with differentials on some of the higher grades of zinc caused the switch away from the "delivered" basis for Prime Western.

•

AT HOME

Although financing for new plant and equipment shows no sign of change, it seems likely a decline in business as a whole is in prospect later this year. This need be no more than a return to "prosperity", rather than "boom", levels. The long-term outlook continues excellent.

Jack Forbes is in as USBM director, with two years to go to retirement age. The Administration isn't adopting a conciliatory policy (to John Lewis, for example), they simply gave up looking for someone else.

In big metal-using industries like utilities, oil refining, chemicals, capital investment in new plants continues unabated.

Boron nitride, produced in certain forms, may have strength and hardness approaching that of diamonds, according to the USBM.

Work-week reductions and lay-offs will cut heavily into U.S. production of zinc shortly. There's still deep disagreement in the industry over tariff protection, which doesn't brighten the outlook for legislative aids.

Professor Carle R. Hayward, long an advocate of greater use of hydrogen as a reducing agent, has a new process of recovering tin from Bolivian ores. It's said to be a low-temperature gas-reduction process.

•

ABROAD

Russia needs metals badly. At least, she's been selling silver, gold, and platinum on the Continent apparently to get funds to buy Sterling-area copper, lead, and zinc.

Reynolds Metals, already mining Jamaican bauxite, has launched a project, costing several million dollars, to mine bauxite in Haiti. According to Irving Lipkowitz, Reynolds' executive, world bauxite reserves now total 2.4-billion metric tons, with only 798-million in Soviet hands.

It's certainly likely, but by no means sure, that Chile will close a deal to get 100,000 tons of surplus Chilean copper into the U. S. stockpile. Meanwhile, the U. S. signed to buy 10,000 tons of tin "to help Bolivia."

MARKETS—Trends and Prices

Buying Movement in Major Nonferrous Metals Slows Down—Zinc Back on Old Selling Basis

DESPITE A COMPARATIVELY high rate of general industrial activity, most fabricators followed a hand-to-mouth policy in placing new orders. Buying interest throughout September centered largely in nearby metal, even in instances where prices were on the low side in our high-cost economy. There was a distinct trend toward reducing inventories of semi-finished and finished products.

Though imports from Chile have dropped off sharply, there was no shortage in the supply of copper available to consumers. The improved supply situation in copper brought on a general reduction in the selling basis of brass-mill products, following a similar move by wire mills announced in the preceding month. Brass mills are now pricing their products on the basis of 30c. copper (was 32.6c.).

The *E&MJ* price index declined from 182.70 in August to 181.10 in September. The drop was caused by lower averages for September in both lead and zinc. Domestic copper was steady, but foreign copper was easier.

The Federal Reserve Board's index of industrial production declined in September to 236% of the 1935-39 average, down 2 points from August. The high for the year was 243 in March.

Cut in Zinc Output

The American Zinc, Lead and Smelting Co. announced Sept. 28 that it will curtail slab zinc production at its Fairmont City, Ill., plant by 1,000 tons a month, effective Oct. 1, and a further reduction will become effective a month later. Total reduction of the company's production of Prime Western grade will come to 25%, it was stated. The continued low prices prevailing for slab zinc and the high cost of production caused the company to take this action. A general reduction in output is likely.

Slab zinc, Prime Western grade, has declined steadily from the ceiling of 19½c., last quoted on May 31, 1952, to the prevailing price of 10c., East St. Louis.

Stocks of slab zinc in the hands of U. S. smelters at the end of August totaled 117,897 tons, the highest level attained since 1947. Imports of slab zinc have been substantial, totaling 180,504 tons in the seven months ended July. Total imports for all of 1952 amounted to 115,148 tons.

The zinc industry has returned to the East St. Louis basis of quoting on the Prime Western grade. The move to market the common grade on a delivered basis collapsed when the American Smelting & Refining Co. announced on Sept. 2 that it is again offering zinc on the basis of the East St. Louis market. Those producers who followed A. S. & R. in breaking away from the basing point on July 16 also went back to the old system of selling zinc. In making the latest change, the A. S. & R. Co. declared "that to meet competition it will for the present charge consumers with freight from East St. Louis to destination, but not to exceed in any case one-half cent a pound."

Copper Unsettled Abroad

Chilean and U. S. officials met from time to time in Washington to iron out the difficulties in arriving at an understanding on the sale of surplus copper for the stockpile. The matter of price has been a stumbling block, along with the terms of a loan. Latest reports from Washington indicate that Chile would like to dispose of at least 100,000 tons of copper.

The question uppermost in the minds of copper officials is what policy will Chile follow after the deal has been concluded? Will Chile market its copper in direct competition with other major producing countries, or will it establish an arbitrary price?

The world price of copper has been easing, particularly where forward deliveries are involved. On the last day of September, for instance, nearby copper sold in the foreign division at close to 30c., whereas December metal actually got down to 27c on a few transactions.

Domestic consumers have been absorbing less copper in recent months because of a slackening in new orders and some uncertainty over the trend of business. They have become quite inventory conscious. Buyers were willing to take on nearby copper at around 30c. level but refused to anticipate any of their wants, even at price concessions. In the first half of 1953, fabricators shipped products to their customers that contained 756,939 tons of copper, an average of 126,156 tons a month. From present indications, shipments in the second half of the year may not average more than 112,000 tons a month.

U. S. production of refined copper in August totaled 106,749 tons, against 112,570 tons in July, according to Copper Institute. Output of crude in August was 82,705 tons, against 88,063 tons in July.

Copper imports in July, the latest month available, totaled 70,296 tons, of which 11,507 tons was contained in ore, matte, etc., 40,790 tons was blister, and 17,999 tons refined. U. S. exports of crude and refined in July came to 10,208 tons.

Lead sales have been in good volume, but with intake fairly large the price was lowered one-half cent a pound to 13½c., N. Y., on Sept. 16. The London speculative market was firm so far as prompt lead was concerned, and there were strong indications that some of the recent buying reflected purchases made for the ultimate account of countries behind the Iron Curtain. This observation also applies to copper. Apparently there is no way of blocking such sales when made through the London Metal Exchange. It was known that Russia has sold platinum silver and

Average Prices for September (E&MJ Quotations)

Copper:	
Electrolytic, domestic, refinery	29.623
Electrolytic, export, refinery	28.688
Lead:	
Common, New York	13.740
Common, St. Louis	13.540
Silver and Sterling Exchange:	
Silver, New York, per oz.	85.250
Silver, London, pence per oz.	74.000
Sterling Exchange, "Checks"	280.271
Zinc:	
Prime Western East St. Louis	10.180
Prime Western, delivered (g)	10.670
Tin:	
New York Straits	82.350
New York, 99% min. (e)	81.350
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$185.200
Antimony (E&MJ) (d)	37.970
Antimony, bulk, Laredo	34.500
Antimony, in cases, Laredo	35.000
Platinum, refined, per oz.	$92.000
Cadmium (a)	200.000
Cadium (b)	207.500
Cadium (c)	215.000
Aluminum, 99% plus, ingot	21.500
Magnesium, ingot	27.000
Nickel (f)	60.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lbs.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.

(e) Tin content.

(f) F.o.b. Port Colborne, U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

Markets Continued on Page 118

gold in the last month or so to obtain transferable sterling to the tune of £9-million. Russia, it is said, is badly in need of raw materials for consumer goods.

The ore markets have been inactive. Large steel companies have been out of the market for manganese ore because of a comfortable supply situation and a desire to reduce inventories. Tungsten was unsettled, with nearby ore available at $41 to $42 per short ton unit of WO_3, c.i.f. U.S. ports, duty extra. Most of the domestic output is currently being absorbed by the Government under floor prices set to stimulate production.

"Free" Gold Market

The volume of sales rose during September by about 15%. Coins were generally lower, with bar gold showing little change, compared with the prices realized in August. Russia sold 250,000 oz. in Western Europe for foreign exchange purposes. This metal failed to disturb the market. Pick's World Currency Report quotes "free" gold as follows, per fine oz.:

	COINS		BARS (12.5 kg.)	
	Aug. 31	Sept. 30	Aug. 31	Sept. 30
NEW YORK, transit	.....	.....	$36 50	$36 35
MANILA	$43 00	$42 25	36 50	36 90
HONG KONG	44 00	43 00	38 50	38 80
BOMBAY	48 00	48 00	47 50	48 35
TANGIER	42 60	41 75	36 50	36 35
BEYROUTH	42 65	41 35	36 60	36 50
PARIS	50 00	48 00	37 60	37 15
BUENOS AIRES	43 00	43 85	39 75	40 00

Note: All prices are computed at the free or black market value of the U. S. dollar in the local markets.

Major Metals

U. S. DAILY AND AVERAGE PRICES

Sept. 1953	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc Delivered (f)	Zinc East St. Louis
1	29.650	29.250	83.500	14.000	13.800	11.250	11.000
2	29.675	29.150	83.750	14.000	13.800	11.000	10.500
3	29.625	29.175	82.750	14.000	13.800	11.000	10.500
4	29.700	28.850	82.750	14.000	13.800	11.000	10.500
5	No Market	29.150	82.750	14.000	13.800	11.000	10.500
7	Holiday	29.025	Holiday	Holiday	Holiday	Holiday	Holiday
8	29.675	29.025	83.000	14.000	13.800	11.000	10.500
9	29.675	28.675	83.000	14.000	13.800	11.000	10.500
10	29.700	29.000	82.000	14.000	13.800	11.000	10.500
11	29.675	28.725	82.000	14.000	13.800	10.500	10.000
12	No Market	28.725	82.000	14.000	13.800	10.500	10.000
14	29.675	28.675	82.000	14.000	13.800	10.500	10.000
15	29.675	28.800	81.250	14.000	13.800	10.500	10.000
16	29.700	28.900	81.000	13.500	13.300	10.500	10.000
17	29.650	28.700	81.250	13.500	13.300	10.500	10.000
18	29.625	28.725	81.250	13.500	13.300	10.500	10.000
19	No Market	28.675	81.250	13.500	13.300	10.500	10.000
21	29.575	28.750	81.500	13.500	13.300	10.500	10.000
22	29.700	28.525	82.500	13.500	13.300	10.500	10.000
23	29.700	28.225	83.750	13.500	13.300	10.500	10.000
24	29.575	28.200	82.500	13.500	13.300	10.500	10.000
25	29.525	28.200	81.500	13.500	13.300	10.500	10.000
26	No Market	28.225	81.500	13.500	13.300	10.500	10.000
28	29.325	28.025	82.500	13.500	13.300	10.500	10.000
29	29.500	28.225	83.500	13.500	13.300	10.500	10.000
30	29.475	28.300	84.000	13.500	13.300	10.500	10.000
AVERAGES FOR MONTH							
Sept.	29.623	28.688	82.350	13.740	13.540	10.670	10.180
AVERAGES FOR WEEK							
Sept.							
2	29.670	29.229	82.917	14.000	13.800	11.208	10.917
9	29.669	28.983	82.850	14.000	13.800	11.000	10.500
16	29.685	28.804	81.708	13.917	13.717	10.583	10.083
23	29.650	28.600	81.917	13.500	13.300	10.500	10.000
30	29.480	28.196	82.583	13.500	13.300	10.500	10.000
CALENDAR WEEK AVERAGES							
Sept.							
5	29.670	29.142	83.083	14.000	13.800	11.083	10.667
12	29.681	28.863	82.400	14.000	13.800	10.800	10.300
19	29.665	28.746	81.333	13.667	13.467	10.500	10.000
26	29.615	28.354	82.208	13.500	13.300	10.500	10.000

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300¢ per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075¢ for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingotbars; cathodes are sold at a discount of 0.125¢ to 0.15¢ per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered, in the East, Middle West, and West, effective Jan. 1, 1951, commanded a premium of 1.35¢ per pound over the current market for Prime Western; Special High Grade 1.50¢.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and fractions of a cent per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, as reported daily by regular suppliers, and is usually one-quarter-cent below the price paid for such bar silver, this deduction being the allowance to such suppliers for carrying, delivering and marketing. In addition to foreign silver, the quotations also apply to domestic silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5¢ per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at .99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Sept. 1953	Sterling Exchange "Checks"	Silver (c) New York	Silver (c) London	Gold London	Gold (d) United States
1	281.0000	85.250	74.000d.	248s.	$35.00
2	280.7500	85.250	74.000d.	248s.	35.00
3	280.7500	85.250	74.000d.	248s.	35.00
4	280.7500	85.250	74.000d.	248s.	35.00
5	(e)	(e)	(e)	(e)	35.00
7	Holiday	Holiday	74.000d.	248s.	Holiday
8	280.7500	85.250	74.000d.	248s.	35.00
9	280.5625	85.250	74.000d.	248s.	35.00
10	280.0625	85.250	74.000d.	248s.	35.00
11	280.0000	85.250	74.000d.	248s.	35.00
12	(e)	(e)	(e)	(e)	35.00
14	279.5000	85.250	74.000d.	248s.	35.00
15	280.0625	85.250	74.000d.	248s.	35.00
16	279.8750	85.250	74.000d.	248s.	35.00
17	280.0000	85.250	74.000d.	248s.	35.00
18	280.0000	85.250	74.000d.	248s.	35.00
19	(e)	(e)	(e)	(e)	35.00
21	280.1875	85.250	74.000d.	248s.	35.00
22	280.1875	85.250	74.000d.	248s.	35.00
23	280.2500	85.250	74.000d.	248s.	35.00
24	280.2500	85.250	74.000d.	248s.	35.00
25	280.1875	85.250	74.000d.	248s.	35.00
26	(e)	(e)	(e)	(e)	35.00
28	280.1875	85.250	74.000d.	248s.	35.00
29	280.1875	85.250	74.000d.	248s.	35.00
30	280.1875	85.250	74.000d.	248s.	35.00
AVERAGES FOR MONTH					
Sept.	280.271	85.250	74.000d.	—	35.00
AVERAGES FOR WEEK					
Sept.					
2	281.025	85.250	—	—	—
9	280.703	85.250	—	—	—
16	279.900	85.250	—	—	—
23	280.125	85.250	—	—	—
30	280.200	85.250	—	—	—

Calendar Week Averages, New York Silver: Sept. 5th, 85.250; 12th, 85.250; 19th, 85.250; 26th, 85.250.

(e) No market (Saturday).

Behind the By-Lines . . .

G. P. Lutjen

A technical article on a smelter in Finland by a metallurgist from Chile in an American mining journal may not be a record in this hands-across-the-sea business, but if it isn't, it comes close. This international dish, served up piping hot by Sr. Fernando Benitez, smelting expert from Santiago, is a full report on flash smelting as practiced at the Harjavalta plant of Outokumpo Oy. Garnished with juicy details from heat balances to furnace dimensions, this is a discussion that metallurgists everywhere can sink their teeth into. So break out your slide rules and finger bowls when you get to page 76.

In writing a feature story, your average magazine interviews "the man in the street" and lets it go at that. Not us! At *E&MJ* we go a step further as you can see in the photograph showing News Editor Jack Kearney (left) on the job in Vermont. To be painfully honest, that moose kept his fool mouth shut and we had to go elsewhere to get the information for the Vermont Copper article (p. 72), but we did want you to realize the boundlessness of our determination to get to the bottom of things.

Fortunately, we not only were able to look around for ourselves at the Vermont Copper diggings, but we ran into a group of well-informed humans. The result is a glimpse at this unique New England mining venture with emphasis on the technical highlights and the people who are making her go. We think you'll find it interesting.

Incidentally, the cover picture this month, tying in with the Vermont Copper story, was taken between moose interviews, by "Hard Rock" Kearney. Future camera portraits by appointment only.

You don't have to be in South Africa starting a new gold mine to reap benefit from "Sound Policies That Can Help South Africa's New Gold Mines", p. 81. If, as we do, you like an article that is fraught with information,—"The fraughter the better," we always say,—you'll find plenty here, from mine financing to the shape of the shaft. This concise but comprehensive piece also shows for the first time, the relationship of the Rand mines to the sub-surface geology. No matter what kind of mining you are doing, you'll find this analysis of the world's largest gold mining area helpful and interesting. If you are in gold mining, it is "must" reading.

Signs of these times: There's a hot dog stand in New Jersey named "The Geiger Counter". Proprietor is Sam Geiger . . . In San Francisco, you can still get a drink for a dime, according to a recent coroner's report . . . Cheapest prospecting we've heard of in a long time was reported in a *Wallace Miner* headline; "Nickel Exploration Program Gets DMEA Approval".

Difference of opinion not only makes horse racing, but some good arguments. An argument that we are currently kibitzing on concerns comminution: Is it better to break rock in the stope with powder or in the mill with a crusher? The "pro" element claims that a little extra blast hole drilling plus a little extra powder can mean lower costs from face to concentrator. Breaking rock finer in the initial blast simplifies loading, haulage, hoisting, and grizzly work, and more rock can be put through the crusher faster. These mining and crushing savings will more than pay for extra drilling and powder. Some "pros" go on to say that overshooting results in more fines to ease the grinding load, and that heavy blasting sets up strains in rock that aid in crushing and grinding that follows.

The "con" faction disagrees almost 100%.

Most people take sides but is this just opinion—or has someone made some screen analyses, time studies, etc. that can offer a positive answer?

Our bulging file labeled "Martini Stories" has been added to by a colleague.

He tells of a fellow who had just walked into his friendly neighborhood tavern and seated himself at the bar, when he noticed an extremely attractive young lady seated three seats to his right. When the bartender approached, the young man ordered 10 martinis to be lined up on the bar in the general direction of the doll. The bartender, a genial host, complied and stood back to await developments. The customer took one sip from the first glass, moved slightly to his right, and after a pause, took one sip from the second glass. He was on the fifth martini when the bartender's curiosity got the best of him. "Look, friend," he asked, "Just what are you doing?"

The young man smiled a happy smile. "I'm going down to the she in sips."

Well, as our old beachcomber friend says with a dispirited shrug, "What can you expect from a day that starts with getting out of bed."

ENGINEERING AND MINING JOURNAL

OCTOBER, 1953

CURTIS W. McGRAW

EVERYONE WHO KNOWS *Engineering and Mining Journal* has known Curtis McGraw, president and chairman of the board of the McGraw-Hill Publishing Co. The enduring mark of his leadership in the task of keeping business well-informed, shaping the technical development of industry and holding the nation to an awareness of its power for greatness and goodness will remain on these pages. But it is something out of our lives that he died last month.

We say everyone who knows *E&MJ* knew Curtis because inevitably the magazine must have reflected his sincerity, his dislike of the superficial, his earnest insistence on a sound editorial job.

He was, after all, brought up in the tradition that a sound, honest editorial job was the only possible foundation for a successful publishing operation. He was the third son of the late James H. McGraw, Sr., founder of the company, whose determination to set, and to reach, the highest possible goals of integrity and achievement in publishing was passed along, undiluted, to his sons.

Born in Madison, N. J., Oct. 13, 1895, Curtis McGraw graduated from Lawrenceville School and went on to Princeton, where he was captain of the varsity football team in 1919. He was a major of infantry in World War I, and saw service in the Artois Sector and in the Meuse-Argonne offensive.

He joined McGraw-Hill in 1920, becoming vice-president and treasurer in 1943. In February, 1950, he was elected president and chairman of the board. No member of the company in that period has failed to be aware of his influence, and to be grateful for it.

What may not have shown so clearly in the magazine was his whole-souled effort to make this company "a good place to work." His cheerful friendliness, given as unstintingly and naturally as sunshine, was felt by us all.

It will be felt, too, by all those who come after him in the administration of this organization. So powerful was Curtis McGraw's warm sympathy for each one of us, so strong was his determination to arouse and to keep the enthusiastic effort and loyalty of every employee, no future administrator of the company can escape this influence, even if he would. Not for years, if ever, will a man in the management of *E&MJ* or of McGraw-Hill, lose the feeling that Curtis is at his elbow. "What would Curtis expect us to do?" will be our guide as surely as it has been in the past. No man, anywhere, could ask for a better guide.

Heads-Up Operation, Closer Study of Geology, New By-Products, Mean . . .

TIGHT FOLD in hanging wall (left) is typical of those found from top to bottom of the orebody. Erosion has cut off top of the fold.

New Life for Vermont's 160-Year Old Copper Mine

GEORGE P. LUTJEN
JOHN H. KEARNEY
E&MJ Staff

THINGS ARE LOOKING UP at Vermont Copper Co's Elizabeth mine near South Strafford, Vt. Present production is 800 tons a day, and as mine manager C. B. Benson summed it up, "For the first time since we reopened the mine 10 years ago, we can see more than a few month's ore ahead." As a matter of fact, at present costs and metal prices, company engineers figure that they have 3 to 5 years' reserve in sight. What is more, they have a couple of aces up their collective sleeve which may make the picture even brighter: first, a thorough study of the geology of the area has been undertaken in the last few years with promising results, and second, metallurgical experiments reveal that several by-products may soon make ore of zones that are now submarginal.

The main ore shoot, containing pyrrhotite, chalcopyrite and some sphalerite with little silver and less gold, runs north and south in the east limb of a tightly folded syncline. The fold axis plunges gently to the north turning almost horizontal at the 975 level, which is the bottom of the syncline. A cross section of the vein would show a number of spurs where tight local folding has occurred in the garnet-mica schist host rock. (See photograph above.) Folding is the most important ore guide, according to Dr. Aimo K. Mikkola, who is doing research geology for the company. Several incontinuous strike faults are connected with the folding. In the north workings a normal fault splits the main body into two shoots.

Ore has been found for several thousand feet along the vein in both directions from the main shaft, with little variation in grade in relation to longitudinal extension and the vein is still open to the north. Vertically high grade copper ore is usually found at the top of the orebody.

Close attention to the geologic picture has been an inestimable aid in mining operations by making possible greater ore extraction and less wasted effort in development. But the big pay-off has been the finding of a new vein in the west limb of the syncline, about 150 ft. in the footwall of the main shoot.

Study of the regional geology revealed several structures similar to the ore-bearing structure of the Elizabeth. One seemed reasonably close by and could be tested by drilling from the lower levels of the Elizabeth. A diamond drill was put to work on the 975 level, and early this year No. 3 vein was cut from a station some 3000 ft. north of the main shaft. Since then, the diamond drill has traced it for a thousand feet back toward the shaft and a cross cut 3000 ft. north of the shaft has hit No. 3 in a pocket that runs 6 to 10% in copper. Overall, however, from drilling results, company engineers expect the new orebody to supply about the same

TALKING OVER OPERATIONS are Geologist Aimo Mikkola (left) and Mine Supt. Clint Miller. Photograph (right), is John Sheedy, mill superintendent.

NEW OREBODY about 150 ft. out from the footwall, running parallel to mine's main vein, is being outlined by diamond drill along 975 level.

SPECIAL JIG simplifies steel sharpening underground.

1.6% Cu heads as do the others.

According to Dr. Mikkola* several similar locations in the area are promising and certainly warrant geologic investigation.

Production

Daily production is provided as follows: 200 tons from No. 2 open pit operation; 200 tons from the south workings where most of the mine's previous production was found; and 400 tons from the north workings which are continually being extended.

Open pit operations are now being carried on to a depth of about 75 ft. They are limited at that elevation by local pinching of the vein which leaves the shovel without room to swing unless it digs an excessive amount of wall rock. Blastholes are drilled by jackhammer, and a 1½ yd. shovel loads a fleet of contractor trucks for the one-mile haul to the mill bins.

Under No. 1 open pit, underground workings will come up to within 10 ft. of the surface. This pillar will be left for weather protection.

Big problem in the pit is water, which makes rough going for the trucks. In winter, open pit opertions are curtailed and production is made up from the south stopes.

Underground Operations

A 400-ft. adit provides access to the main shaft. Ore, hoisted in skips is hauled by trolley in 6-ton Granby cars to the mill feed bins.

Underground mining practice at Vermont Copper is dominated by two features — the shape of the orebody and an exceedingly long haul from the main working areas to the mine's only shaft. Otherwise the ground is good, ventilation, water and hoisting present no unusual problems.

Eight stopes are in production. Short orebodies are mined by shrinking; shrinkage plus sublevel benching are used for higher ones. The orebody is undercut, and mined high enough by shrinkage to empty the bottom of the block. The stope is drawn and benching started. Preferably, ore is extracted by mucking machines at drift-level draw points, but scrams and scrapers may be used.

According to Mine Supt. Clint Miller, design of draw points and the system of loading can make a big difference in mining efficiency. Ideally the drawpoint is about 10 ft. wide and has a brow as low as it can possibly be without interfering with the mucking machine operator. The low brow restrains the muck, lowers the possibility of broken ore avalanching across the drift, the main haulageway.

Back from the brow the roof is arched quickly to give the loader plenty of room. Normally, cars on the main haulage track are loaded from the side by the mucking machine working back and forth on rails into the drawpoint, perpendicular to the main line. When the orebody is wide enough to permit a spur parallel to the main line, the mucking machines sideloads the cars spotted on this spur and the main haulage is kept open.

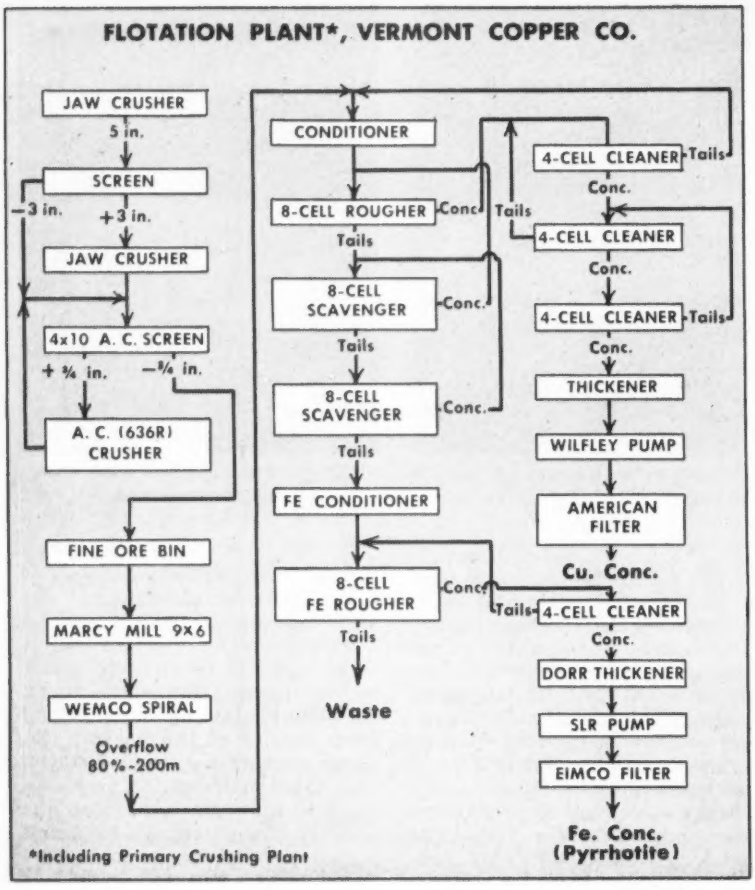
Another arrangement was tried but proved unsatisfactory. Shallow draw points permitted broken ore to cascade into the drift and up against a substantial bulkhead which kept the drift from being blocked. The loader operated on a spur off the main line with the mine car on the spur behind it. Not only did end loading prevent full cars, but after loading each car had to be pulled off the spur, the switch thrown to move the car down the track so that the next car could be spotted on the spur for loading.

Table I. Operating Data

	Production Tons of ore	Grade % Cu.	Cost Per Man Shift Index	Cost per Lb. of Cu. Index	Tons per Manshift
1944	91,641	2.26	100	100	2.25
1945	82,943	2.43	114	93	2.55
1946	126,782	2.56	130	85	2.96
1947	146,396	1.69	124	134	2.79
1948	144,914	1.65	125	144	2.65
1949	222,636	1.58	158	100	5.16*
1950	245,451	1.58	172	90	6.25*
1951	230,052	1.831	175	113	4.27
1952	260,701	1.624	198	140	4.42

*Possibility of shutting down led to curtailment of all development work.

* In collaboration with Dr. McKinstry of Harvard University, Dr. Mikkola will publish a comprehensive paper on geology of this area in a forthcoming issue of *Economic Geology*.



Sublevel Stoping

Sublevel benching using a scram drift and slushers is the alternate mining method on this long straight orebody. At present this method is used only where the ore is found an excessive distance above the drift. President John F. Cowley gives a good picture of it by likening the bottom of the orebody on the 975 to the keel of a ship. Going "aft" it gradually starts to bend upwards. In the Elizabeth mine, when this bending brings the ore 12 to 20 ft. above the drift, the ore is mined by sub-level stoping. There is no sharp cut off to decide between shrinkage and sublevel stoping: depends on local conditions.

Why mucking machines are preferred to scrapers can be seen from figures in a recent report from Miller. Mucking machines handling 118,584 tons of rock handled ore at the rate of 60.4 tons per man shift. Scrapers, loading 101,604 tons showed 26.3 tons per man shift, a beter than 2-to-1 advantage for the mucking machine over the scrapers.

Standard practice calls for 30 ft. pillars, 170-ft. stopes. Subdrifts are driven off from pillar raises approximately every 35-ft. are used for benches in the stopes while light jackleg machines with integral steel and tungsten carbide chisel bits are used for drifting.

Steel is usually sharpened underground in a short crosscut off the main drift. A special jig (see accompanying photograph) makes steel sharpening routine. In remote areas a nipper sharpens steel with a portable air-powered grinder.

Miller subscribes to the theory that ore should be well broken at the initial blast to the smallest size possible. This he feels simplifies loading, hauling, grizzlying, hoisting and crushing, improves ventilation and reduces mine maintenance. Little secondary blasting is necessary and, when necessary, explosives in a plastic bag are very effective as mud caps.

Tramming from the north end of the 975 level where 50% of the company's production is being mined is a 2,000 to 4,000-ft. haul. This is too far for efficient haulage by the little one-ton Manchas so a double track arrangement is located about halfway down the drift toward the shaft. The Manchas tram loaded trains to this point where a 3-ton Titan picks them up for a fast haul to the shaft pocket, returning the empties to the switch.

In the near future a 4-ton 39-hp diesel will take over this chore. There are a few points along the main haulage route where timbering for chutes does not leave enough clearance for the diesel. When these points have been widened, the diesel will start in service. It has worked in the south end and results have left no doubt in the management's mind about the unit's proficiency.

USBM recommendations call for 75 cfm. air per horsepower. In the north of the 975 level two 15-hp blower pulls 7,500 cfm. through two churn drill holes which is more than adequate ventilation as far as mining is concerned. Total ventilation through the upcast main shaft is 35,000 cfm. with 12,000 cfm. coming from the south workings, the remainder through the north.

Comparatively little water, about 125 gpm. is made in the mine. One 75-hp. Pomona pump, capable of pumping 350 gpm. against a 700-ft. head, handles the entire flow. An identical pump is installed as a standby. Water is picked up in a sump on the 975 level and pumped to the surface.

All drilling is done on one shift. Tramming requires three shifts. Labor distribution is as follows:

Mining	20%
Tramming	50.1%
Service	21.4%
Diamond Drilling	2.9%
Bosses	5.6%

Mining costs, given in Table I, show clearly how increased efficiency is pitted against rising labor and material costs to keep the cost of a pound of copper to the mill from jumping out of sight. Note that the unusually high productivity indicated in 1949 and 1950 does not give a true picture. At that time there was a strong feeling that the mine would be shut down and operations were confined for the most part to developed ore. As a matter of fact, when back development work (that the company is just now catching up with) is considered, the 4 + tons per man shift in 1951 and 1952 are even more impressive.

Concentrator

Round-the-clock operation is required for the mill to keep up with the 800 tons of ¾-in. feed coming in from the crushing plant. Flotation plant capacity could be upped to about 1,000 tons daily if crushing plant supplied ½ in. feed. For this reason Vermont Copper management is considering installation of a rod mill.

Flotation practice is straight forward, as may be noted from the accompanying brief flowsheet. Here is a typical mill assay report:

	% Cu	% Zn	% Fe
Heads	1.50	0.57	20.5
Concentrate ..	24.0	1.40	31.1
Tails	0.14	0.38	18.8

Silver paid for—2.6 oz./ton

According to Mill Superintendent John "Pat" Sheedy, the biggest headache in mill operation is variation in day to day recovery of pyrrhotite under identical operating conditions. To float, pyrrhotite must be activated with copper sulphate or sulphuric acid or both. The pH of the pulp only slightly affects pyrrhotite recovery.

Experience has also shown that some of the pyrrhotite is in an unstable form and if too much of this type of the mineral is recovered in the concentrate, it will oxidize rapidly after filtering. This can generate enough heat to set the concentrates on fire.

A pH from 9.0 to 9.3 is maintained in the copper circuit. If pH gets outside this range, an excessive amount of chalcopyrite particles appears in the tailings.

Retention time in the flotation cells is 20 min. but it will be upped to 30 min. when a new bank of scavengers is added. Preliminary tests show that this change will lower the copper tails to about 0.10.

In the Marcy mill, pulp density is held at about 78% and the resulting grind produces a classifier overflow in which 80% of the ore is ground to minus 200 mesh. Solids in the classifier overflow and on the rougher flotation feed are held close to 35%. Lower solids on the flotation feed has little effect on copper flotation but does result in a lower pyrrhotite recovery.

Sheedy and his mill foreman, Charley Adolph, run the mill with a total crew of 23 men, 12 of whom are operators. One step that is saving in maintenance time, is the use of Utaloy in the mill liners. Life of the shells has increased from 190,000 tons to 270,000 tons since the mill switched from the manganese.

Crusher jaws are reconditioned by hard surfacing with Manganal rod. Reconditioned jaws will last about 50% longer, as compared with new ones bought for replacement, and cost only half as much. Gordon Tracy, master mechanic, makes it clear, however, that the welder must have plenty of experience to get these results.

Rubber lined pumps also are cutting maintenance costs. One pump handling abrasive sands had to have new parts every six weeks. Since it was rubber lined in November 1952 no new parts have been needed.

Handling copper tails is no problem. Pyrrhotite tails which are kept separate, must be watched because of fine mica and talc slimes whose angle of repose in the toe of the dam is lowered when tailings get wet. Recent installation of concrete pipe for dewatering, instead of wooden underground launders, will remedy this.

Copper concentrates are shipped to Laurel Hill, N.Y., for smelting. About 70 tons a day or 1/3 of the pyrrhotite produced is shipped to a paper manufacturer where sulphur is recovered. Vermont Copper retains an interest in the calcine from this operation, which is presently being stockpiled. All that prevents the calcine from being made into a high-grade iron sinter is the presence of about 1.25% zinc. However, research people are on the track of a method to get rid of this zinc which cannot be permitted in steel furnaces.

Another interesting possibility is the production of electrolytic iron directly from pyrrhotite ore. The product is strongly magnetic and is the only iron directly from this ore. Vermont Copper has already produced some on a pilot plant basis which was sold to the AEC at $1.00 per lb.

Either or both of these possibilities can make an important difference in the profit and loss statement. Right now both projects have reached the point where a discussion of plant site and financing is next on the agenda.

Men Make the Mine

In short, the last 10 years of Vermont Copper Co. operations is the story of a war baby making good. True, the mine is a high-cost producer—(besides costs indicated in Table I, there is a 6 to 7¢ freight, smelting and sales charge that cannot be controlled at the mine), but with its sound geologic approach, the maturing of present metallurgical plans plus modern mechanized mining and sound management, the company will hold its own.

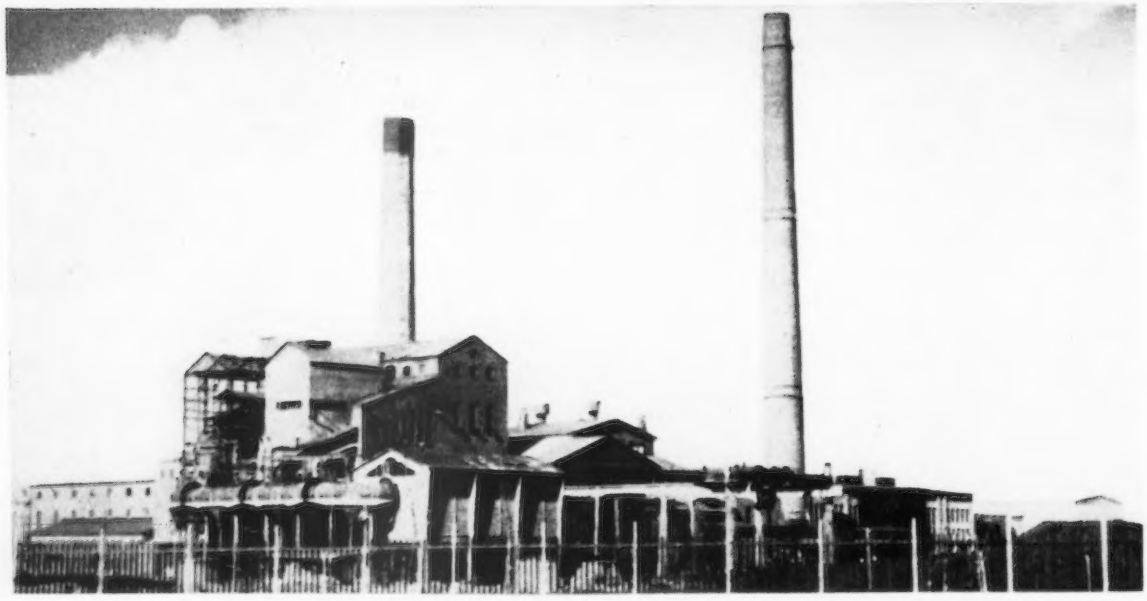
Perhaps even more important than the potentials of geology and metallurgy are the people at Vermont Copper, up and down the line. In the last analysis it's men who make a mine.

On a payroll of 215 people, more than one-third have been with the company for more than 5 years. Turnover is less than 2% a month. Most of the labor is local men with an acre or two of land under cultivation. They are good workers and have become top notch miners.

Vermont Copper too has good first line supervision, men who have stuck to their posts when things were tight, men who know the mine and equipment like the backs of their hands. Men like Asst. Mine Supt. Charles Banker; Foremen Charles Judd, George Austin, Dan Murphy, Ralph Ward and Henry Lens; Master Mechanic Gordon Tracy; Mill Foreman Charley Adolph; Electrical Supt. Joe McClay, all are the type that makes up the backbone of any mine.

When the margin between cost and selling price is small, it takes good management and technical know-how to stay in business and Pres. Cowley, a mining man who has been around from Arizona to Ankara, has just such a staff: C. M. Benson, a mine manager who believes in maintaining a well satisfied working force and who has successfully fought the mine's "sugaring off" for 10 years; Clint Miller, a mine superintendent with experience at Butte and elsewhere. Aimo Mikkola, top grade geologist from Finland with a Ph.D. from Harvard; Dick Little, chief engineer and native Vermonter; Pat Sheedy, a mill superintendent who's been everywhere.

Finally, no story could be written about Vermont Copper Co. without mentioning George Ellis and ex-Governor Stanley Wilson. For them, mining copper in Vermont is not only a matter of state pride (until the copper strikes in Michigan in the '60s, Vermont was this country's biggest producer), but the mine's payroll is one of the mainstays of a happy and prosperous community in that corner of Vermont. It was the faith and determination of Mr. Ellis and his associates which has helped Vermont Copper grow from a war baby to a sound commercial enterprise.



OUTOKUMPO OY'S SMELTER at Harjavalta is 130 mi. northwest of Helsinki and 19 mi. from the port of Pori where the company has a copper refinery. Outokumpo is owned by the government of Finland.

Flash Smelting Improves

FERNANDO BENITEZ
Santiago, Chile

BLISTER COPPER in one operation is the target at the Harjavalta (Finland) smelter of Outokumpo Oy and the company metallurgists are coming close with their adaptation of flash smelting. Chief refinement added by metallurgists Petri Bryk and John Ryselin of Outokumpo Oy to previous practice, is the preheating to 500 deg. C. of the air injected with the feed, to make the process autogenous. At present Harjavalta is producing matte of grades varying between 69 and 71% copper. An 80% matte has been obtained—white metal with no iron—but metallic copper cannot be avoided, probably because measurement and control of air is not precise.

Even falling short of the target flash smelting has many benefits. It does not require extraneous fuel, smelting is easy to control, a high-grade matte is obtained and capital cost is lower than for conventional type smelters.

Background For Flash Smelting

In 1931 at Anaconda, Frederick Laist and J. P. Cooper carried out a series of experiments which may be considered as the forerunner of flash smelting developed at Harjavalta by the Finnish metallurgists, Messrs. Bryk and Ryselin. According to the authors, "The general idea was to roast flotation concentrates, mixed with the proper fluxing materials, by dropping them down a heated shaft, from which the calcines would enter the smelting zone of the reverberatory furnace through an opening in the roof."

The roasting shaft used by Laist and Cooper was only 3 ft. square inside with an effective height of 20 ft. and was superimposed on the hearth of the reverberatory which was 3 ft. wide by 21 ft. long. The reverberatory could be fed either directly through the arch in the regular way with hot calcines or by means of cold concentrates suitably fluxed which were fed continuously by a cone at the top of the shaft. Air for combustion was blown in through a pipe also at the top of the shaft.

According to the authors, the shaft was operated both in combination with the reverberatory furnace and alone. The use of the shaft increased the capacity of the smelting furnace 2½ times and decreased the fuel consumption per ton of charge 60%. The considerable increase in smelting capacity the authors attributed to the high temperature at which the shaft calcine enters the smelting chamber, 1470 deg. F. (799 deg. C.) and not to the hot gases from the roasting shaft. Actual figures for this test were: a) Furnace operated without the shaft on calcine having a temperature of 492 deg. F., 16.678 lbs. per 24 hours with an oil consumption of 797 gal.; b) When running in combination with the roasting shaft, the furnace smelted 40,552 lbs. cold, dry concentrates per 24 hours with an oil consumption of 762 gal.

Another conclusion was that the shaft had a much greater capacity working alone than when operating in combination with the reverberatory furnace since the capacity of the shaft was limited by the smelting rate in the reverberatory. Test runs proved this to be so as the feed rates were 40,552 lb. when the shaft was connected with the furnace, the moisture content being 0.38% and the sulphur in feed and in calcine 31.5 and 22% respectively; while when the shaft was used as a roaster alone, its capacity increased to 80,911 lbs. dry feed (0.37%) and 34.6 and 15.1% being the sulphur in feed and calcine. With moist feed (2.61%) its capacity

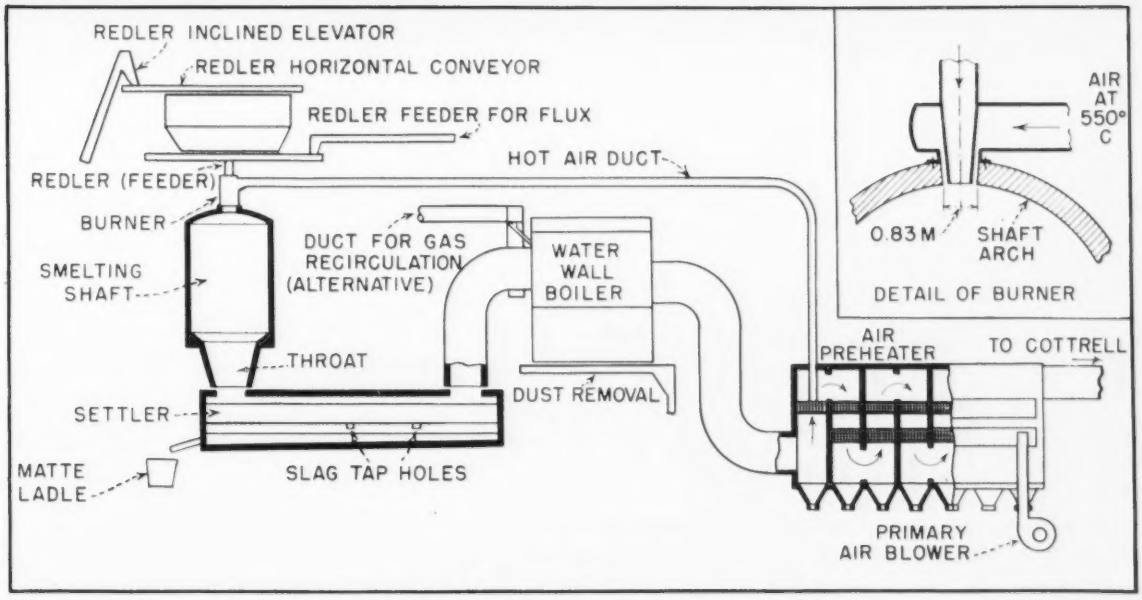


FIG. 1. Two keys to autogenous smelting are: (1) the burner arrangement shown in inset, and (2) the arrangement of the water-wall boiler to cool gasses before they enter the air preheater.

Harjavalta's Metallurgy

was 87,655 lbs. per 24 hours, the sulphur content in feed and calcine being respectively 34.8 and 14.3%.

The authors arrived at the conclusion that the capacity of the roasting shaft is a function of the volume of the roasting chamber, assuming that sufficient air to burn the sulphur and oxidize the iron is introduced with the concentrates and that a shaft 6 ft. square with an effective height of 30 ft. would roast about 250 tons per day producing calcines with 15% sulphur. The SO_2 content of the gases was high, over 10%. A standard reverberatory was considered with 3 roasting shafts 6 ft. square by 30 ft. high in each side of the furnace and a capacity of 1,500 tons of concentrates per day was expected from such a combination. This plan was unfortunately never carried out.

The great forward step introduced by Messrs. Bryk and Ryselin was to preheat the air to 500 deg. C. This made the process autogenous, except for the very small amount of fuel needed to dry the concentrates before feeding them to the shaft. That the preheating is absolutely necessary, can be predicted from the heat balance figures.

Heat Balance of the Process

If we take a concentrate made up of chalcopyrite 66%, pyrite 24% and gangue (silica) 10% and suppose that we obtain from the smelting thereof a 70% copper matte, a slag containing 40% iron (51% FeO) and that the matte, slag and gasses leave the furnace at 1,300 deg. C. (2,370 deg. F.), 1,000 kg. of such a product will contain 228.4 kg. of copper; 312.6 kg. of iron; 359 kg. of sulphur, and 100 kg. of SiO_2. On smelting it will yield 326 kg. of matte whose theoretical composition will be: Cu, 70% (228 kg.); Fe, 8% (26 kg.), and S, 22% (72 kg.).

Amount of iron and sulphur available as fuel will be: Fe, 312 — 26 = 286 kg., and S, 359 — 72 = 287 kg. The slag will weigh 286/0.4 = 715 kg. and its composition will be: FeO, 368 kg.; SiO_2, 100 kg., and 247 kg. of suitable fluxes which will have to be added. The theoretical quantity of oxygen needed for oxidation will be 200 cu. m. for sulphur and 58 cu. m. for iron or a total of 258 cu. m. oxygen at atmospheric temperature and pressure, which is equivalent to 1,230 cu. m. of air.

The outgoing gases will be made up of 200 cu. m. of SO_2 and 972 cu. m. of nitrogen, or a total of 1,172 cu. m. with 58 cu. m. of oxygen combining with iron to form FeO.

One metric ton of this concentrate will produce 122 kg. of free sulphur. Of this, 58 kg. S will be obtained from the 660 kg. of chalcopyrite, and 64 kg. from 240 kg. of FeS_2. These reactions are endothermic and take place thus:

$$2\,CuFeS_2 = 2\,CuS + 2\,FeS + S$$
$$\Delta H = 18{,}630 \text{ K cal.}$$
$$FeS_2 = FeS + S$$
$$\Delta H = 15{,}980 \text{ K cal.}$$

On decomposition, the 660 kg. of chalcopyrite will absorb 33,500 K cal. and the 240 kg. of FeS_2 will take 32,000 K cal. or a total of 65,500 K cal.

Pyrite on oxidizing to SO_2 will produce 122 kg. × 2,210 K cal. or 270,000 K cal. Therefore, the net heat obtainable by the oxidation of free sulphur will be 270,000 — 65,500 or 204,500 K cal.

FeS on oxidizing produces 112,450 K cal. The amount of iron and sulphur available as fuel will be 286 + 287 — 122 or 451 kg. and the heat liberated by this fuel is 451 88 × 112,450 or 577,000 K cal.

The 286 kg. of iron oxidize to 368 kg. of FeO which reacts with SiO_2 to produce a slag. This re-

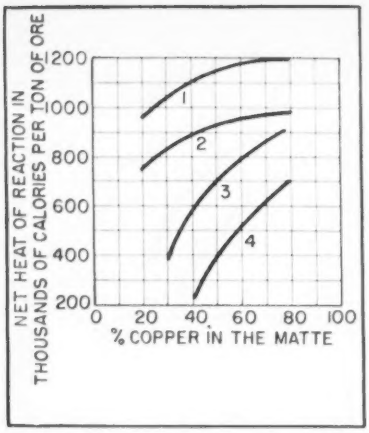


FIG. 2. Net reaction heat in smelting 4 grades of ore or concentrates.

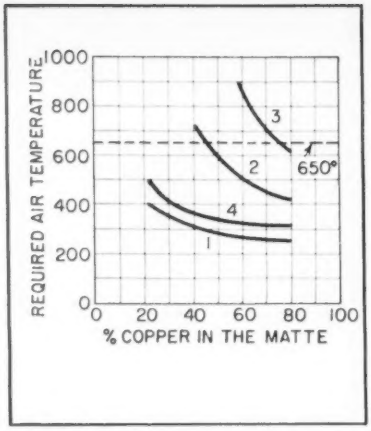


FIG. 3. Preheating required for autogenous smelting of 4 grades of feed.

action will liberate 100 K cal. per kilogram of iron. This is a total of 286 kg. × 100 or 28,600 K cal.

Then the total heat liberated will be:

Due to the oxidation of sulphur	= 204,500 K cal.
Due to the oxidation of FeS	= 577,000 K cal.
Due to the formation of slag	= 28,600 K cal.
Total net heat	= 810,100 K cal.

In this system heat is taken out by the matte, the slag, and the gases for all of which we have supposed a temperature of 1,300 deg. C., the matte containing 222 K cal. per kilogram and the slag 340 K cal. per kilogram.

Heat contained in the matte and slag:

Matte:

326 K × 222 = 72,300 K cal.

Slag:

715 K × 340 = 243,100 K cal.

The gases will carry away the following quantities of heat:

SO_2: 200 × 714 = 142,800 K cal.

N_2: 972 × 445 = 432,500 K cal.

575,300 K cal.

Heat losses by radiation, convection, etc., have been calculated at a maximum of 100,000 K cal. per ton of concentrate. Adding this to matte, slag and gas losses, total heat removed is 990,700 K cal.

The heat balance shows that the heat taken out of the system is 180,600 K cal. greater than the amount put in. It will also be seen that about 58% of the total heat in the system is carried away by the gases. Therefore, the heat deficiency can be remedied if the air for combustion is preheated outside the system. In this particular case, the heat carried away by the gases is ample enough to preheat the combustion air to the required temperature. We have seen that the heat deficit amounts to 180,600. 180,600 K cal./1,230 cu. m. = 146.8 K cal. per cu. m.

This enthalphy corresponds to heating the air to 458 deg. C. and then we can balance the incoming and the outgoing heat, thus:

Net heat of reaction	= 810,100 K cal.
Net heat in air at 458 deg. C.....	= 180,600 K cal.
Heat put in.....	= 990,700 K cal.

From the heat balance the conclusion is drawn that there is no theoretical difficulty in carrying out autogenous smelting. In order to illustrate the possibilities of the process, the curves shown in Figs. 2 and 3 have been drawn for four different classes of actual ores and concentrates.

Class I. Low grade pyritic ore: Cu, 5.0%; Fe, 39.6%; S, 45.4%; gangue, 10%.

Class II. A normal type of concentrate whose composition is similar to the one chosen for the heat-balance: Cu, 20.0%; Fe, 32.6%; S, 37.4%; gangue, 10%.

Class III. A concentrate rich in copper made up of 90% chalcopyrite and 10% gangue: Cu, 31.2%; Fe, 27.4%; S, 31.4%, and gangue, 10.0%.

Class IV. An ore poor in copper containing 25% gangue: Cu, 5.0%; Fe, 32.6%; S, 37.4%, and gangue, 25.0%.

Fig. 2 shows the "net reaction heat" of these four classes of ore or concentrate in K cal. per ton of ore and expressed as a function of the grade of copper in the matte. Class I gives, of course, the greatest amount of heat and Class III the lowest. From this we come to the conclusion that in autogenous smelting with a rich copper concentrate, we should also get a relatively rich matte. Notwithstanding that the net reaction heats of these various classes of ores and concentrates are quite different, Fig. 3 shows that all of them can be smelted autogenously when the matte has the necessary copper grade and when the combustion air has been heated to the required temperature. It is considered possible for the gases to reach a maximum temperature of 650 deg. C., but for technical reasons connected with the heat exchanger, this temperature must not be exceeded. Fig. 3 shows the grade of matte that can be reached with the four classes of ore. Ore No. 1 rich in pyrite and poor in copper can produce a 20% Cu matte by autogenous smelting and preheating the air to a temperature of about 400 deg. C. If the matte grade reaches 80% Cu, the air need only be preheated to 265 deg. C.

Concentrate No. 2 can be autogenously smelted provided the grade of matte is about 45% Cu. For this concentrate to produce a matte of 60% Cu requires that the air be preheated to about 500 deg. C.

Class III, which is the richest in copper, has a relatively low reaction heat (Fig. 2). As a consequence, a matte at least 75% Cu must be obtained and the air must be preheated to 650 deg. C. Class IV ore, which carries 25% gangue, can be autogenously smelted with a 20% copper matte and an air temperature of 490 deg. C.

The Smelter at Harjavalta

The concentrates arrive at the smelter containing 7 to 9% moisture.

The average composition of the Outokumpu concentrates smelted at Harjavalta, is as follows:

Cu	21.35%	86.52%
Fe	31.04%	
S	34.13%	
SiO_2	7.20%	9.70%
Al_2O_3	1.50%	
CaO	1.00%	
Au	0.10 oz. per ton	
Ag.	1.10 oz. per ton	

In recent months the silica con-

tent of the copper concentrate has been increased to 13%. As this silica is a more finely divided product than the sand originally used, the slagging reaction proceeds more rapidly and a slag of lower copper content is obtained. The aim is now to obtain almost a "free fluxing" copper concentrate in which this product contains about 90% of the silica needed to slag the iron. The other 10% of the silica required is added as a fine sand.

For the smelting to proceed autogenously it is essential that the concentrates should be fed to the shaft bone dry. Therefore, the concentrates are dried in a rotary kiln 66 ft. long by 6 ft. diameter inside the refractory lining. Capacity is 350 tons per 24 hours. Fuel-oil consumption is 16.5 lb. per ton of dry concentrates. The gases before being vented are passed through a Cottrell unit to precipitate the suspended dust. The concentrates come out of the kiln at 120-150 deg. C.

A Redler elevator 105 ft. high, inclined at 70 deg. carries the concentrates and fluxes to concrete bins on the highest floor of the building. Fluxes made up of (a) a silicious sand and (b) burnt lime (CaO) as well as the flue dust obtained from the whole of the process, are also elevated by the same Redler elevator to another bin located near the concentrate bin at the same level. To the large concentrate bin where the wet concentrates are dumped is added about half the amount of fluxes the concentrates require (more or less 7% of sand and lime).

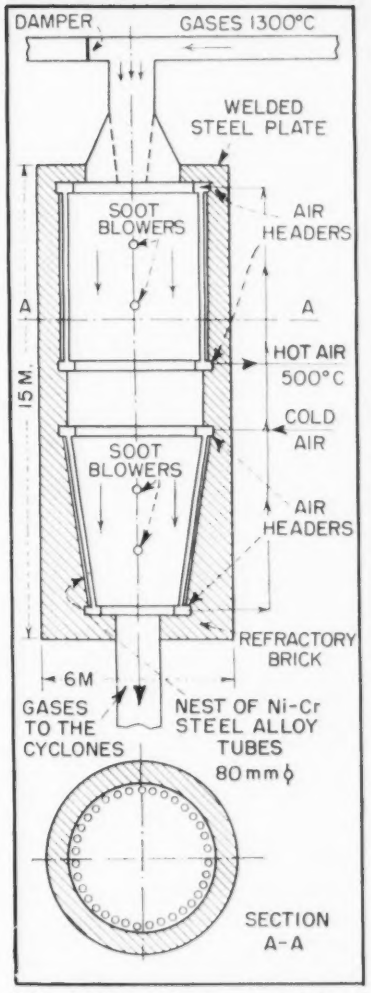


FIG. 4. This preheater was tried and didn't work. Accretions built up on tubes despite soot blowers.

The Furnace

The 26-ft. tall smelting shaft of the furnace has an inside diameter 3.54 m. (11.60 ft.). The walls are built entirely of magnesite brick. At its lowest part, just above the reverberatory furnace, the diameter of the shaft is reduced to 2.55 m. (8.40 ft.) and then to 2.0 m. (6.60 ft.). Reducing the diameter of the shaft just before connecting it to the furnace increases the velocity of the gas stream and consequently of the suspended particles, giving them a strong impinging action on the slag bath. As the area of the shaft is about 3 times the area at the throat where the shaft joins the reverb or settler, the velocity is increased three times. A change in direction also takes place from a vertical to a horizontal flow. As a consequence, only a relatively small amount of flue dust is carried out from the settler if it is assumed that originally all particles were in suspension.

The arch of the shaft has three openings at 120 deg. to insert oil burners to heat up the shaft until the temperature of the air for combustion reaches 500 deg. C. and the smelting is autogenous.

Of great importance in this process is the "burner" placed at the center of the shaft and which is made of cast steel having at its center two concentric tubes. The dry concentrate and fluxes are fed through the inner tube and fall freely down the shaft while the hot air is forced under a small pressure through the annular space between the two tubes. The diameters of the two tubes have been dimensioned in such a way that suspension is uniform when the charge and hot air leave the burner.

The furnace, whose function is to settle the matte away from the slag, has an outside length of 18.50 m. (60.70 ft.) and 17.0 m. (55.80 ft.) inside length; is 4.50 m. (14.80 ft.) wide and 2.38 m. (7.80 ft.) high from bottom to arch. The settler is also built of magnesite brick and has the standard form of a reverberatory furnace with tapholes for matte and slag.

When the preheated air at 500 deg. C. and the charge or mix made up of concentrates and fluxes meet in the upper part of the shaft the "free sulphur" distills off instantly and ignites on account of the prevailing heat. This produces an appreciable rise in temperature and roasting, smelting and part of the converting reactions take place during the few seconds that the particles are in suspension. The main reactions are completed when the charge comes in a molten state to the settler. The horizontal furnace serves merely as a reservoir and settler although part of the slag reactions are completed here.

Normal feed to the shaft varies between 9 and 15 metric tons of concentrates per hour (216 and 360 tons per day). The uptake for the gases is 2.0 m. (6.80 ft.) in diameter.

The gases leave the furnace between 1,300 and 1,350 deg. C. (2,370-2,460 deg. F.). Due to this high temperature, most of the flue dust is in a molten state and can give serious trouble by building up accretions. The amount of flue dust varies between 2 and 5% of the tonnage of concentrates charged to the furnace. The gases are very rich in SO_2, containing between 13 and 15% of the gas.

Heat Exchanger Problems

As the heat balance shows, the heat exchanger is essential to carry out autogenous smelting. When flash smelting started at Harjavalta, the tube and shell exchanger shown in Fig. 4 was installed to preheat the air, but great trouble developed on account of the molten flue dust. The exchanger consisted of two sections, one superimposed on the other whose form is similar to that of the stator in a Fagergren cell. Each of the two sections was made up of a series of tubes 3" in diameter evenly distributed around the inner circle of the shell. These tubes were welded to the headers above and below. The space between the tubes and the outside cylinder, which was made of welded steel plate to make it airtight, was

Table I. Analysis of the Flue-Dust

	Water-wall boiler	Pre-heater	Cyclone
Cu	27.85%	14.43%	14.43%
Zn	3.48 "	2.52 "	18.19"
Fe_2O_3	52.49 "	61.11 "	41.10"
SiO_2	8.30 "	6.11 "	11.20"
S	5.11 "	11.71 "	13.58"

Table II. Gas Data

Average volume of gas liberated ..... 21,000 cu. m. per hour (740,000 cu. ft.)

Maximum volume ..... 25,000 cu. m. per hour (890,000 cu. ft.)

Temperature at which the gases leave the furnace: 1,300 deg. C.

Composition of the dry gases: SO_2 = 12—15%

O_2 = 1— 2%

N_2 = 84—90%

filled in with refractory brick. Because most of the flue dust was in a molten state, it stuck to the tubes and began to accumulate and gradually cool off, reducing the efficiency of the exchanger. Though the exchanger was supplied with soot-blowers placed along the axis of the cylinder, these proved to be totally incapable of blowing off the hard and growing dust accretions. This situation led to frequent shutdowns for cleaning and the tube material, made of a Ni-Cr steel alloy, became brittle.

At first it was thought that the diameter of the cone, which fed the hot gases into the exchanger, was too great and that, as a consequence, the molten dust particles were thrown against the tubes. The shape of this cone was altered in the form shown by the dotted lines (Fig. 4) so as to throw the dust particles to the center of the exchanger instead of to the sides, but no marked improvement was observed as the molten dust particles stuck to the tubes further down. It was necessary to abandon the upper half of the exchanger and work with only the low half and finally the whole tube and shell exchanger had to be condemned.

To keep the plant operating temporarily, it was decided to install another preheater using extraneous fuel. This preheater worked satisfactorily and the plant operated without trouble, but it was no longer autogenous since 3.5% of fuel-oil per ton of concentrate was needed to preheat the air the equivalent of 370,000 K cal. per ton of concentrate. According to the heat balance, it was seen that 180,600 K cal. were required to heat the 1,230 cu. m. of air required for the process, so that the efficiency of the new preheater was 49%. As the furnace at that time was not furnished with a waste heat boiler, the hot gases were cooled by a water spray upon leaving the furnace.

To achieve autogenous smelting and avoid the troubles experienced with the tube and shell exchanger, which worked on the radiation principle, it was decided to install an exchanger that would operate on convection. Such a type of heat-exchanger, however, only works properly if the gases are cooled down to a safe temperature before entering the exchanger.

To do this and at the same time not waste heat, it was decided to make the gases go through a large cooling chamber, a water-wall boiler, where the gas temperature would drop from 1,300 deg. to 950 deg. C. It is expected besides, that the water-boiler by cooling the gases below the fusion point of the dust particles will solidify these and cause them to drop inside the water-wall chamber on account of reduced velocity. As an alternative, and also for the sake of safety, the water-wall chamber may also be used as a mixing chamber where the hot furnace gases may be cooled down to 950 deg. C. by means of recirculated cold gas or with a water spray.

Fig. No. 1 shows the principle on which the new heat-exchanger works. The hot gases pass successively through eleven metallic chambers or cells built of a special alloy, each chamber being 2.15 x 1.68 x 0.94 m. (7.10 x 5.50 x 3.10 ft.). The hot gases go through these chambers vertically while the air passes horizontally. To keep the gas-passages free from accretions of dust particles, the exchanger is provided with a series of oscillating arms from which hang pieces of chains which will move to and fro within the spaces, through which the gases circulate. The boiler will develop 1,500 kw.

How the Gases are Cleaned

Gases after going through the water-wall boiler and the heat exchanger, pass through a battery of 40 cyclones, 650 mm. (25 in.) in diameter. It is here where the main pressure drop occurs. The pressure in the primary air blowers (centrifugal fans) is 500 mm. (20 in.) water gauge while the induced draft fans are rated for 120 mm. (4.75 in.). The gases, with an average SO_2 content of 13%, go to the H_2SO_4 plant, which has a capacity of 250 tons per day.

Average concentration of solids in the gases is 14 g. per cu. m. As the smelter presently operates with the "water-wall boiler Nadel air preheater," the flue dust is collected at the following points:

	% of dust	% of the feed
Water-wall boiler	26.4	1.07
Between boiler and preheater	20.9	0.85
Preheater	24.1	1.02
Cyclones	27.1	1.13
Loss	1.5	0.15
Total	100.0	4.22

It is evident from the analyses (Table I), and especially from the sulphur content of the dust, that the smelter gases have a considerable sulphatizing action on the dust.

An electric precipitator will replace the cyclones which will be dismantled. The draught loss will be considerably reduced and it is also believed that a cleaner gas will be obtained. The melting point of the dust is apparently between 1,000 and 1,100 deg. C. (1,830 and 2,010 deg. F.) according to the experience gained with the tube and shell exchanger.

When smelting with the autogenous process a matte running about 65% copper is obtained. The average composition of the slag is as follows:

Fe	40-42% (50.7-54% FeO)
SiO_2	29-31%
CaO	2-4%
Cu	0.81%
S	0.8-1.2%

The fuel and power consumption are as follows:

16.5 lb. of fuel-oil per ton concentrate for drying.

3.5% of fuel-oil per ton concentrate for preheating the air when the hot gases could not be used.

Primary air blowers: 125 hp.

Induced draft fans: 100 hp.

SKETCH PLAN (believed to be the first produced) showing old and new gold mines in relation to the Witwatersrand as a whole.

TABLE I. Present Status of New Development

"West Wits" line to Klerksdorp

LIBANON. Producing at 1,000,000 tons a year.
WEST DRIEFONTEIN (U.) Expanding producer of great richness.
DOORNFONTEIN (U.) Developing. Producing in 1954.
STILFONTEIN (U.) Producing at 800,000 tons a year.
HARTEBEESTEFONTEIN. New Lease mine. Preparatory work.
VAAL REEFS. Developing from one shaft.
ELLATON (U.) Developing.

Orange Free State (Main Section)

ST. HELENA. Producing at 800,000 tons a year.
WELKOM (U.) Producing at 800,000 tons a year.
WESTERN HOLDINGS (U.) Developing. Mill in commission
FREE STATE GEDULD (U.) Developing. Mill nearly ready.
PRESIDENT STEYN (U.) Developing. Mill erected.
PRESIDENT BRAND (U.) Developing. Mill nearly ready.
LORAINE. Developing.
JEANNETTE. Sinking one shaft.
FREDDIES NORTH. Developing. Mill ready.
FREDDIES SOUTH. Developing. Mill ready.

O. F. S. (Sand River Section)

HARMONY. (U.) Developing. Mill under construction.
VIRGINIA (U.) Developing. Mill under construction.
MERRIESPRUIT (U.) Developing.
(U.) Potential uranium producer

Sound Policies That Can Help South Africa's New Gold Mines

One of South Africa's foremost mining men has kindly consented to prepare this penetrating and constructive review and analysis of the Rand's new gold mines, but modestly requests anonymity.

DIAMOND-DRILL EXPLORATION upon the Westerly extensions of the greater Witwatersrand has dwindled to insignificance and most of the new mines are now gradually taking shape.

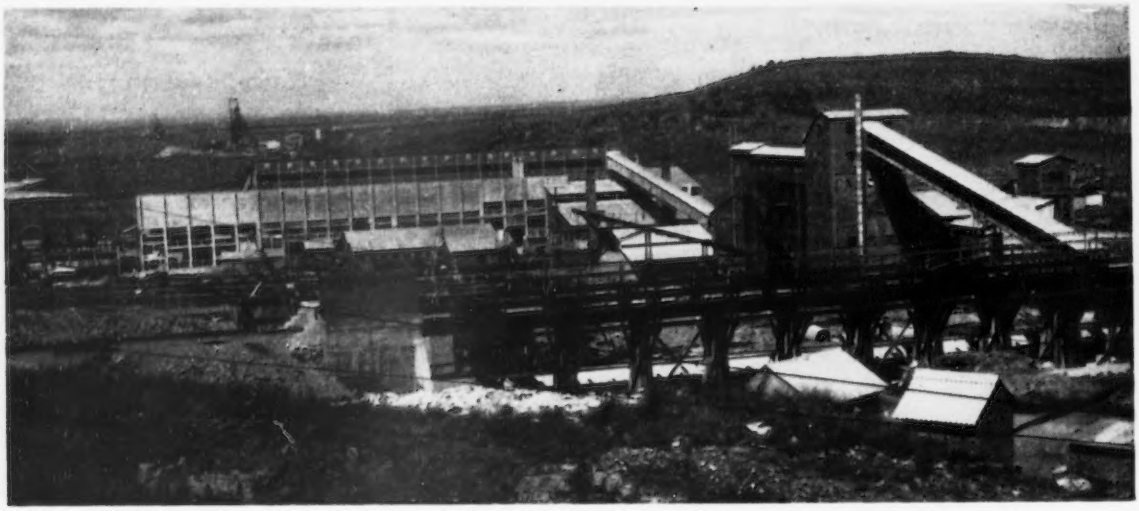
For the Orange Free Station section, particularly, 1953 will be a fateful year. By December some 800,000 ft. of development will have been done for twenty shafts, of which footage over 25% will be in ore. Three million tons of ore will have been milled. Although economic possibilities will then be widely disclosed, the fulfilment of estimates will be severely tempered by the shortage of underground laborers. An additional 40 to 50-thousand unskilled workers could be comfortably absorbed by the Rand, old and new, next year.

The rush with which the creation of new gold-producers has been attempted since the war is overstraining the resources of the country. On the "West Wits" line there has been an orderly expansion, but no such gradual and helpful process has aided companies in the Orange Free State. The present expansion is shown in Table I.

Mills Built too Soon?

Some of the new mills have been crushing ore from development faces, for running-in purposes and providing for gold absorption in the cyanide works, but the broad picture is of seven reduction plants, awaiting stope ore, built in advance of the ore reserves required to serve them profitably. Prewar Marievale, influenced in policy by different capital redemption practice, may be mentioned in contrast. This mine declared an ore reserve before erecting a mill and had it in commission twelve months from the start of construction. Nowadays, the mill comes first, often to the dismay of underground executives.

Nearly all the new mines are laid



WEST DRIEFONTEIN, richest of the new mines, started milling in 1952, and earned £2¼-million profit by mid-1953 with small first-stage plant. This mine is also a potential uranium producer.

TABLE II. What It Costs to Bring a Deep Mine Into Production

Excluding mining rights, commonly acquired for shares, the expenditure required to bring a deep new mine to production on an economic scale is working out roughly as follows:

Field exploration and preparations	£ 250,000
Sinking two vertical shafts to 4,500 ft.	1,400,000
Headgears, hoists, and auxiliary surface construction	1,400,000
Underground equipment and early development	800,000
Production development, stope preparation and additional equipment	1,400,000
(The preceding four stages of work would take about 5½ years).	
General plant, buildings and works	1,100,000
Housing and amenities for European employees	1,800,000
Native accommodation	500,000
Reduction works: 60,000 tons monthly	900,000
Administration and general	650,000
Stores and materials: stock	300,000
Total expenditure	£10,500,000

out with big reef-bearing areas, in accord with sound principles established by the Mining Leases Board and are judged to be capable of milling at least 1-million tons annually for over forty years. Royalties or lease terms have been fixed by the government, on meager borehole evidence, assuming undisturbed or unobstructed expansion to an early stage of dividend payments. Visiting American engineers have often expressed astonishment at the confidence displayed by South African mining men in estimates of yield based on the results of borehole intersections, sited with a density of about one per square mile—one sample for several million tons of ore in a deposit changing rapidly in value, almost foot by foot. To the Leases Board nearly all prospective mines appear destined to be of good grade. The royalties and taxes imposed are too onerous for a field likely to contain some disappointing mines, the poor results of which have to be offset against the proceeds of successful ventures. Imposts are fixed too high for a young country in constant need of fresh capital.

Cost of a New Mine

The one thing now proved to be certain about a deep undeveloped lease property is that about £11-million has to be spent upon its equipment and development before any return is gained by shareholders. Production started in the Free State in 1951 and funds for a mere 5% dividend are not yet visible in a company's treasury. £35-million of risk capital was employed last year, upon all new mines, without allowance for loan capital on uranium projects.

Expenditure is influenced by development and stoping policy. Milling before the creation of an adequate ore reserve—which the Kennecott Copper Corp. is believed to have discouraged at the Virginia Mine—affects the preproduction outlay inevitably. In earlier days, a mine would do 50,000 ft. of development on reef before production; now this may be under 20,000 ft. Nevertheless the cost will sometimes be just as heavy relatively, owing to the incidence of water inflows, gas and friable shale, to the greater footage in country rock, and the lack of assistance underground from neighboring mines.

Financing New Mines

Much has been written about the new methods of raising funds for the equipment of O.F.S. mines through corporate or institutional loans, because of the weakness of the sources from which risk capital was once so freely drawn for the support of mining ventures. Ex-

RICH HARMONY MINE will be producing gold and uranium in 1955.

MANAGER F. S. MULLER at Virginia No. 1 Shaft where one world record for sinking speed was broken.

orbitant taxation of incomes in Britain is held largely responsible for the adverse change, though the unprecedented magnitude of recent capital demands and losses incurred in the "Kaffir" Stock Market have been discouraging factors. The rich new gold mine, in which the speculative investor has full confidence, should not have to go begging in the worst of times. During 1953, such mines may be proven by results, but other will be found to present little speculative appeal. A suspension of development in the poorest mines would be welcome in some quarters—easing the competition for labor, warning government and public of the mining risks and serving the interests of mineral conservation, to which South Africa may be tempted to pay too little heed. Our American instincts are lacking. Resources of gold ore, though truly vast, are not inexhaustible. The chances of finding large new fields are dwindling. Exploration of a detached section of the Witwatersrand basin, to the East of the Far East Rand, is now in progress, but discoveries comparable to those recorded in the West are not to be expected in the light of current knowledge.

"Billion Ounces of Gold"

To date, about 1,900-million tons of ore have been milled upon the Rand, for a yield of 500-million ounces of gold. If the new fields should fulfil their promise and if the Old Rand is allowed to retain sufficient labor to work to the maximum economic depths envisaged by

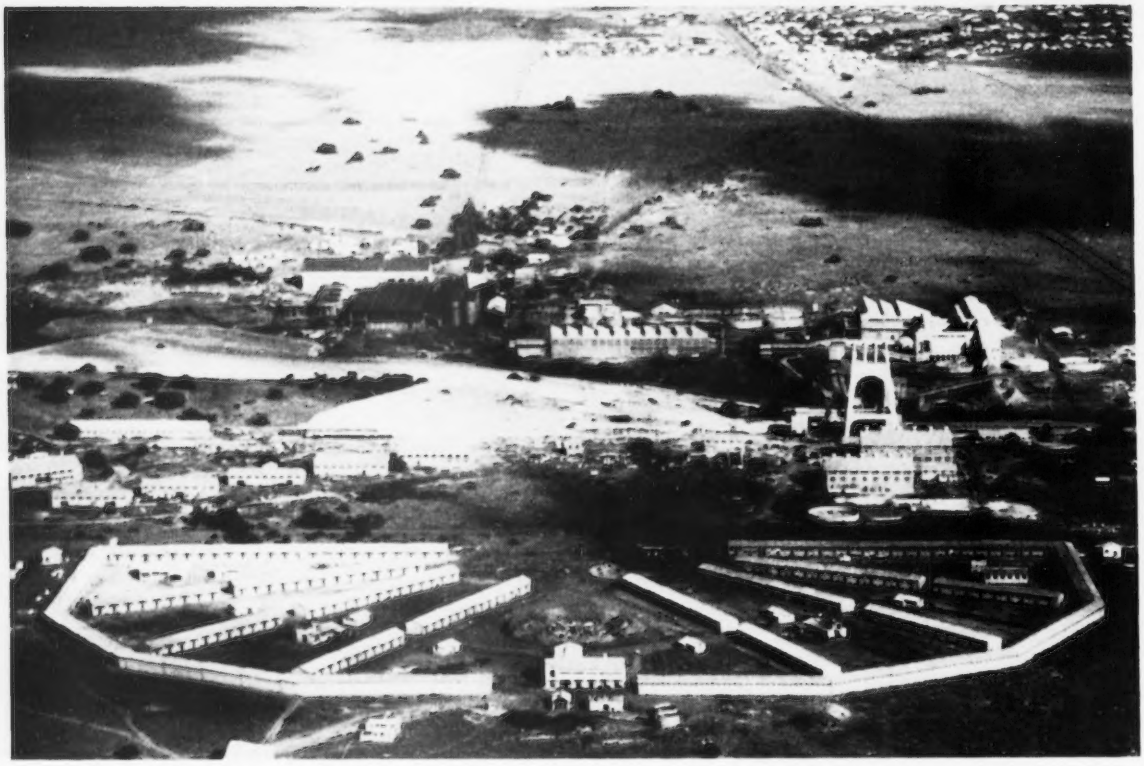
WESTERN HOLDINGS made its first output declaration in August. Milling capacity is 75,000 tons monthly. Northerly development aims to explore rich boreholes put down in 1945.

State Commissioners, then it may be predicted with fair confidence that as much ore remains to be mined, as extracted in the past, and that the ultimate yield of the Witwatersrand will approach 1-billion ounces of gold.

American mining influence is again in the ascendant. During the earliest phase of the Rand's development—a period of 25 years spanning the Anglo-Boer War of 1899-1902—our engineers were preeminent in the control of technical practice and policy. They were chiefly responsible for building up the fine reputation of the gold field for soundness of method and for lucidity and integrity of report.

American interest has been revived and strengthened by South African uranium developments, pioneered in collaboration with U.S.A. government representatives and also by the Kennecott's important investment in the Orange Free State. The flotation in 1946 of the American Anglo-Transvaal Co. created a new link, though short-lived, between Johannesburg and New York.

Kennecott's first participation in financing of the Virginia and Merriespruit mines was affected at a time of speculative excitement and its importance was then not fully appreciated. Some interests suggested, it is said, that too much was being done by way of favored terms, to induce American com-



STILFONTEIN SURFACE PLANT includes concrete headframe, radial-type native quarters, gold reduction works (right center) and uranium leach plant (left center). European residences built by company (background).

panies to come in. Few today feel so greedily possessive. More thought appears now to be given to the distribution of financial responsibilities than to a monopolizing of ultimate rewards. Johannesburg hopes that Kennecott will extend its commitments. Good opportunities for investment will surely arise. The makings of success will be detected, by those competent to judge, through the lifting haze of underground uncertainties.

Fog of Uncertainty

Rand mining houses can help to clear the haze. Reports are not always as full or prompt or explicit as they used to be; not always up to American standards. The mystery of uranium economics has been allowed unduly to intensify the fog without much early protest against extravagant demands for secrecy. Chamber of Mines President McLean is now urging that the blanket of secrecy be lifted. Shareholders should be given, members of the Stock Exchange declare, the tonnage and gold value of the ore reserve from which uranium is drawn. In some mines, the ore reserve for gold and uranium will be the same. In others, notably in the old mines, there would be two separate ore-reserve declarations, one of which may be unworkable at a profit without the additional revenue from uranium. The declared profits from uranium also call for clarification. How much of it is due to tax relief upon amortization of loan capital? What are the deductions for repayment of capital and interest?

Which Shaft Shape?

The big rectangular shafts, however, are proving well adapted to the needs of early district ventilation, with two up-cast compartments divided from four downcast by a brattice wall. Hoisting capacity is greater. Two rectangulars, followed by a circular ventilation shaft—put down when the trend of activity is better known—would serve admirably the needs of any Free State mine for many years.

Twin circular shafts have found support and would have more in their favor if correct siting in relation to underground values and other conditions, could be predetermined with reliability. Normal layout gives two widely separated points of attack, at first exploratory—an element of strength likely to outweigh the temporary advantage of an earlier connection between twin shafts. The elliptical shaft, a compromise, has not grown in popularity.

In spite of full cementation cover, two shafts have been temporarily lost in the Free State through flooding, but shaft-sinking difficulties have not been as great as those experienced at some points on the "West Wits" line, where mud-filled fissures and cavities are found to surprising depths in the weathered and irregularly decomposed dolomite. One shaft, still struggling to depth, has taken 5 years to sink 2,000 ft.

World Records Broken

Against this figure, one world record of 504 ft. was sunk in a 30-day month in a 24-ft. circular shaft on Virginia, with the use of a double-deck sinking platform and four crews of sinkers instead of the usual three. Mechanical grabs were not used for mucking out the shaft, in this particular operation, but grabs are likely to become standard practice to save labor.

The new world record was then broken in May 1953, when 585 ft. was sunk on the Vlakfontein Mine, Far East Rand. In this project, at a depth approaching 6,000 ft., time as well as labor was saved by the use of an air-operated "cactus" grab used for mucking.

In the "battle of the shafts," the honors have gone to the circular because the demand for big quantities of downcast air will be exacting. Virgin rock temperature of 103 deg. F will be found at the bottom of the average shaft and 114 deg. F at 6,000 ft. Air may be delivered fairly cool and dry to the bottom of the downcast shaft, especially in winter months, but air currents may travel only a few thousand feet through drifts and stopes before a critical wet bulb temperature of 89 deg. is reached. Beyond this, there is the danger of heat stroke and the certainty of low human efficiency on the job, even for well-acclimatized native laborers.

In development, cementation cover is commonly provided by means of diamond-drill holes, 250 to 300 ft. long, in advance of drift faces. Major water channels are sealed. Lesser flows are left for the pumps. Stoping operations in some areas are likely to be influenced adversely by the occurrence of an unstable bed of so-called "khaki" shale in the hanging wall, close to the orebody. This will be difficult to hold; at its worst, impossible. Resuing methods of stoping may be widely introduced in the hope of insuring a moderate milling width.

Complicated Working Costs

Working costs, complicated by development charges debited to capital and housing expenses, are being declared at 42s. 6d. to 45s. per ton milled by the three new mines working on Basal Reef. Of this, ore treatment accounts for only 4s. 6d. per ton. There is no sorting out of waste rock on surface, for mills are not being run to capacity and occasional high values in wall rocks have discouraged sorting efforts. Adverse underground conditions, notably water and gas, check the hope of much improvement on these cost figures, even though the heavily faulted Western Reefs mine across the Vaal River, is showing creditable costs of 35s. per ton, milled, with 10% sorting.

Hope Lies in Higher Grade

It is to higher grade, not lower costs, or big scale production that the new gold field must look for its prosperity. The scale of milling employed by some of the companies upon the Old Rand will not be attained upon the New for many years to come. If the grade expectations of such outstanding mines as Western Holdings and Harmony are fulfilled, such big-scale milling will not be needed for success.

Shareholders Need Facts

From the gold mining companies, shareholders need colored working plans, on a scale of 1: 10,000, as issued by Welkom G. M. Co., lately, and more enlightenment on shoot conditions, if such prevail. Areas stoped, stoping widths, tonnages and grade of ore drawn from ore reserves—such figures would help the mining public.

From the Government, foreign investors seek practical evidence of their wisdom and equity in dealing with racial problems, in encouraging unity between the major sections of the European community and in giving scope to the natives for general economic advancement on the lines followed by mining controls in the Belgian Congo.

Free State Conditions

Good and bad physical features have been disclosed in opening up the Free State goldfield. The principal orebody—the "Basal Reef"—is as persistent as the wider gold carriers of the Main Reef series of the old Rand. Encouraging values in borehole and shaft intersections are being followed up by good development results.

Dolomite, the menacing water reservoir overlying the mines of the "West Wits" area, is absent and a steady diminution of water difficulties is to be expected in course of time.

Uranium content of Basal Reef is stated to be economic, and even rich in certain mines.

Against these factors, there are some unfavorable conditions. The thermal gradient is severely steep for wet mining. In certain areas, weak lenticular beds of shale in the hanging-wall of the orebody are liable to cause impoverishment of mill grade. Methane gas is more prevalent than elsewhere on the Rand. Ore-reserve declarations and results of milling to date have been disappointing.

Current yields of about 4.0 dwt. per ton have not been in line with publicized expectations, based on borehole results for individual properties or for the Free State goldfield as a whole. Improvements can, however, be looked for confidently, and soon.

7 dwt. Estimates Vs 5 dwt Ore

Shareholders have been puzzled by the wide discrepancy between the declared value of payable development in Free State mines and the related ore-reserve grade. On Welkom, 25,000 ft. of payable development (61% of the total sampled) was given in reports, at 7.0 to 8.0 dwt. over a stoping width, prior to the declaration of an ore-reserve at 5.0 dwt.

Sharp Definition Needed

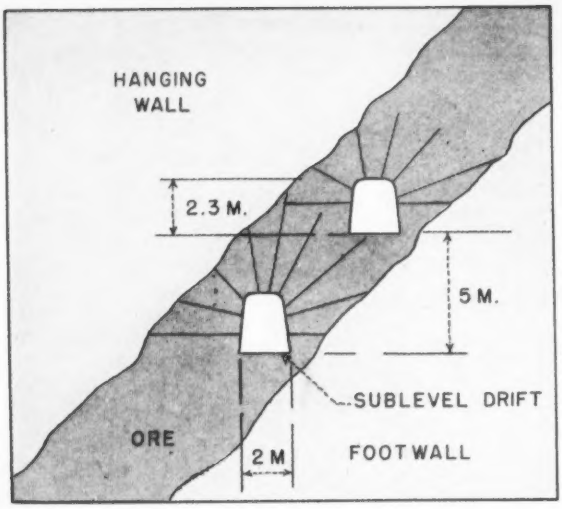
Unless there is a high percentage of payability or a sharp definition between payable shoots and poor areas, the declared values of "payable development" are difficult to interpret and apt to mislead the uninitiated.

Grade of ore is the most critical and uncertain factor today in the assessment of future prospects. Development policies have not helped to clarify the outlook. Apart from the proportionably small footage or reef, there is a modern tendency to do less drifting in favor of raises. Grade determination and control must suffer. There is already speculation enough in estimates of future yield, and it is to be hoped that the cutting down of development in reef drives will not be carried to extreme.

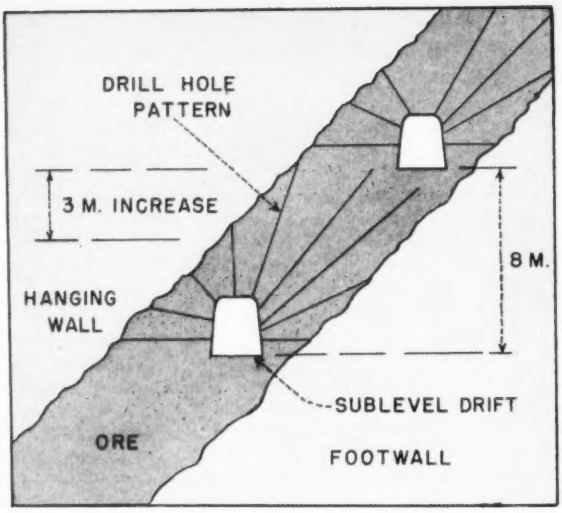
Modern Technical Methods

Rand mining engineers, past-masters in the art of vertical shaft-sinking to great depths, have gained much new experience in the last few years. Since the war, over 32 miles of main shaft sinking has been done at an average speed of 120 ft. per month and cost of about £150 per foot, including shaft equipment.

Rectangular shafts, roughly 47 ft. by 11 ft. in area of excavation, are in the majority, owing to the advantageous standardization introduced by the leading group, responsible for fourteen of the new shafts. It is now generally accepted that the 24-ft. dia. circular shaft is, by and large, the best proposition for prevailing conditions. There are fifteen new ones to date. With protective cementation cover and concrete lining, circular shafts have proved the most favorable for sinking through the prevalent soft or water-fissured ground.



BEFORE. With round steel the depth of holes drilled limited the sublevel drift interval to 5 m.



AFTER. Use of flat drill steel permitted the sublevel drift interval to be increased to 8 m.

Why Mines in Norway and Sweden Adopted Flat Drill Steel

C. C. AUSTIN, retired General Manager of Mancha Division, Goodman Manufacturing Co., reports on another interesting technical development encountered in his current travels in Europe.

DRILLING WITH FLAT STEEL is another unusual technique I have seen on my recent trip to Norway. This system was adopted at Fosdalens Bergverks, Malm, Norway, in order to permit the operators to increase the sublevel interval from 5 m. (16.4 ft.) to 8 m. (26.3 ft.). Here are the details:

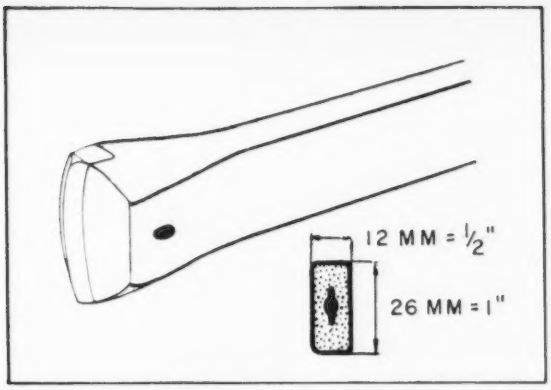
Some of the ore here lies at too flat an angle to permit shrinkage stoping. Consequently sub-level caving is used instead. The system is shown in the accompanying sketch. Obviously the vertical distance between the two caving drifts is limited by the depth of drill holes. When round steel was employed, the depth of vertical holes was somewhat less than height of the drift, and the horizontal holes were less than the drift width.

It was quite apparent that if longer holes could be drilled, the vertical drift interval could be increased, and the tonnage broken per drift could be increased considerably.

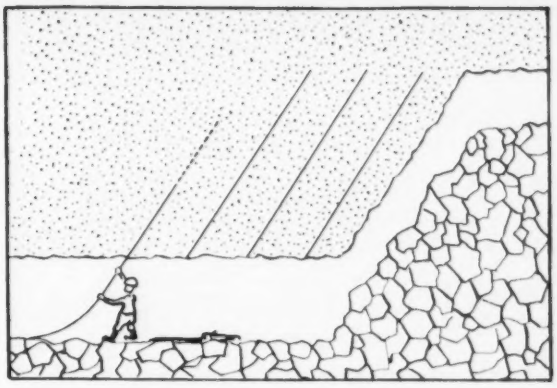
What was needed was a flexible drill steel that could be bent so as to insert it in a partially completed drill hole. Fortunately, the Sandviken Iron Works in Sweden produced just such a steel for wet drilling. This steel is fitted with tungsten carbide chisel bits.

Adoption of this steel enabled the Fosdalens Bergverks operators to increase the sublevel drift interval to 8 m. Holes can be drilled 9.6 m. deep with this new steel. Drilling speed with the flat steel is 23 cm. per min. as compared with 30 cm. per min. with round steel. Tungsten carbide bits have to be sharpened after about 90 m. of drilling.

C. C. AUSTIN, author of this article (above), introduces his friends at Fosdalens Bergverks, Malm, Norway. They are Ivar Berge, general superintendent (center) and C. W. Carstens, chief mining engineer for the Fosdalens Bergverks mining project (right).



FLEXIBLE COROMANT DRILL STEEL made by Atlas Diesel comes in lengths of 2 ft. 7 in. to 31 ft. 8 in.



FLAT BAR DRILL STEEL was used in Sweden's mines to increase the lengths of holes drilled in shrinkage stopes.

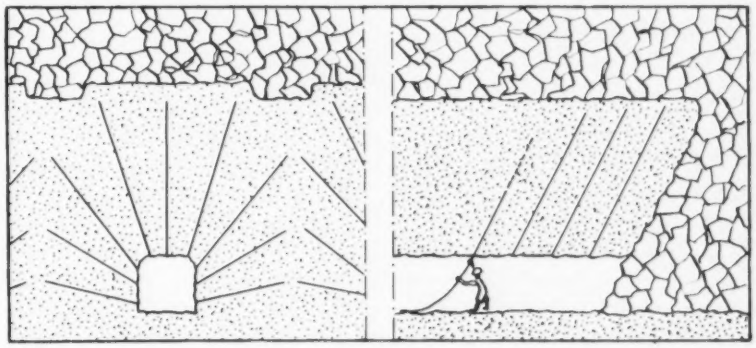
While in Sweden, I called on the Atlas Diesel people to find out more about this amazing flat steel, and here is what I learned:

In Sweden the flat drill steel made by Atlas Diesel is used in both shrinkage and sublevel caving operations where restricted dimension of sublevel and development drifts limit the depth of hole that can be drilled. It would be possible of course to use jointed round steel, but operators here feel that this becomes quite a complicated operation, especially when the holes exceed 18 ft. (5.5 m.) in length. Accordingly a number of companies have standardized on flat steel to permit drilling of thicker slices for sublevel caving and shrinkage stopes. In one mine it has been possible to increase the thickness of slices from 26 to 49 ft. (8 to 15 m.) as a result of adoption of flat steel.

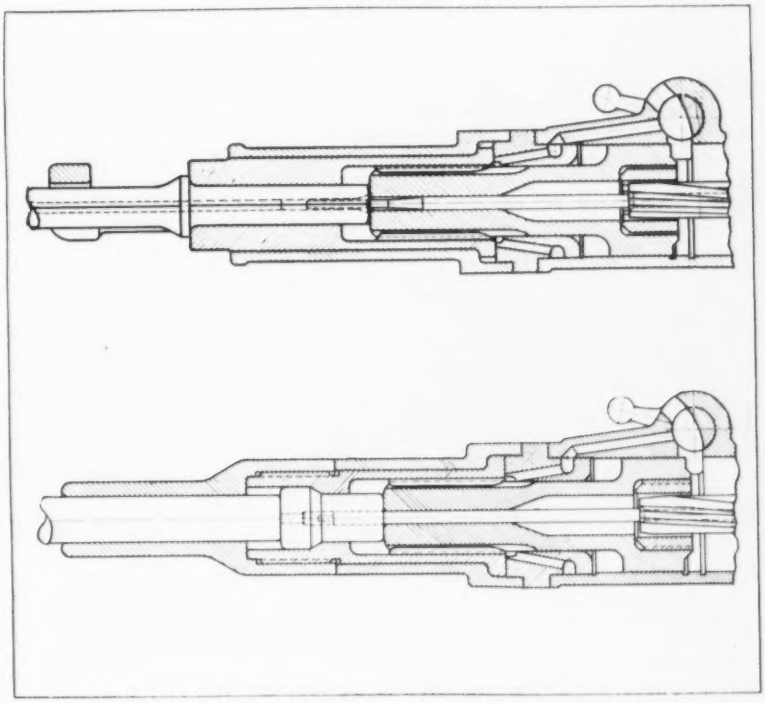
Dimensions of the flat bar stock used to make the drill steel are 12x26-mm., or about ½x1-in. (See illustration.) The steel cannot be fitted with a collar on the shank end, and so it has been necessary to revise the design of the pneumatic pusher-type drill to accommodate an anvil to transmit the power of the rock drill to the steel. See drawings of old and revised rock drill designs (at right).

The steel is available in lengths of 800 mm. to 9600 mm. (2 ft. 7 in. to 31 ft. 8 in.). Bit diameter ranges from 34 mm. for the 800-mm. steel to 28 mm. for the 9600-mm. length (i.e., 1.34 to 1.10 in. in dia.).

In concluding this round-up of information on flat steel, I want to thank my friends Ivar Berge, general superintendent, of Fosdalens Bergverks, and C. W. Carstens, chief engineer, for their generous hospitality during my visit, also the Atlas Diesel people.



FLAT BAR DRILL STEEL fitted with tungsten carbide integral chisel bits was used here to increase drill hole length in sub-level caving system.



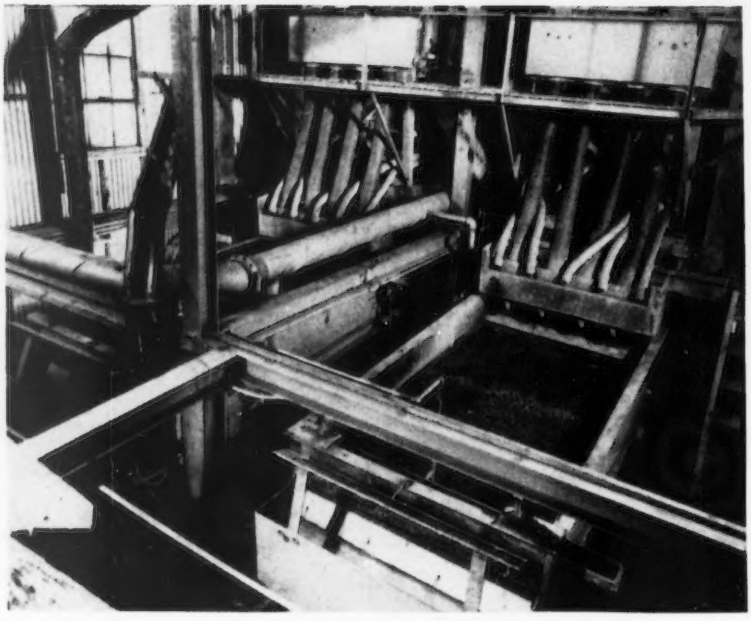
FLAT BAR DRILL STEEL cannot be fitted with collars at the shanks. Therefore conventional drill design (above) had to be modified to include anvil.

19.6-Million Tons!

That's the total of concentrates produced from Minnesota's intermediate iron ores in 1952.

Varied methods of beneficiation in plants, large and small, are used to prepare the steadily growing tonnage of ores that require such treatment before they can be utilized in the blast furnace.

ABE W. MATHEWS
Abe W. Mathews Engineering Co.
Hibbing, Minn.



JIGGING is still in the iron-ore beneficiation picture in Minnesota, among the various procedures used in preparing lean ores for shipment. Here is seen the Remco two-stroke jig in Skubic Bros. plant at Virginia, on the Mesabi.

More Iron from

THE FIRST large-scale plant for the treatment of Minnesota intermediate iron ores was built about 1910. Since then the tonnage of concentrate made from these ores has grown from year to year, forming an ever-increasing proportion of the total Minnesota ore shipments, in 1952 aggregating 19,645,824[1] long tons or 30.36.%. The flowsheets of the concentrating plants, starting originally with a simple washing process, have become more and more intricate.

Treatment of intermediate ores in Minnesota is seasonal work. It starts in April usually and ends in October, a period in which freezing weather is not a hazard. No attempt is made to heat the plants in cold weather. The winter season is used for maintenance and alterations.

In general, a plant serves just one mine. However, a number of them are arranged to take ore from several pits, usually for the plant operator's account. Two are now being operated on a custom basis part of the season. A third custom plant will be completed this summer.

Most of the plants are of steel-frame construction, covered with uninsulated corrugated sheet-steel.

Crude ore is brought to the plant either in trucks or railroad cars. Usually it is dumped into a hopper of moderate capacity which delivers to a manganese-steel pan feeder, a machine that has largely supplanted the chain grizzly. Ross chain feeders are sometimes used in this application. The feeder drive should be of a variable-speed type, remotely controlled, preferably from the operator's station.

[1] *Skillings Mining Review*

Recently an elliptical-roll, or "wobbly," feeder has been developed. This is intended to replace both the conventional feeder and the following scalper. A commercial unit is already in operation.

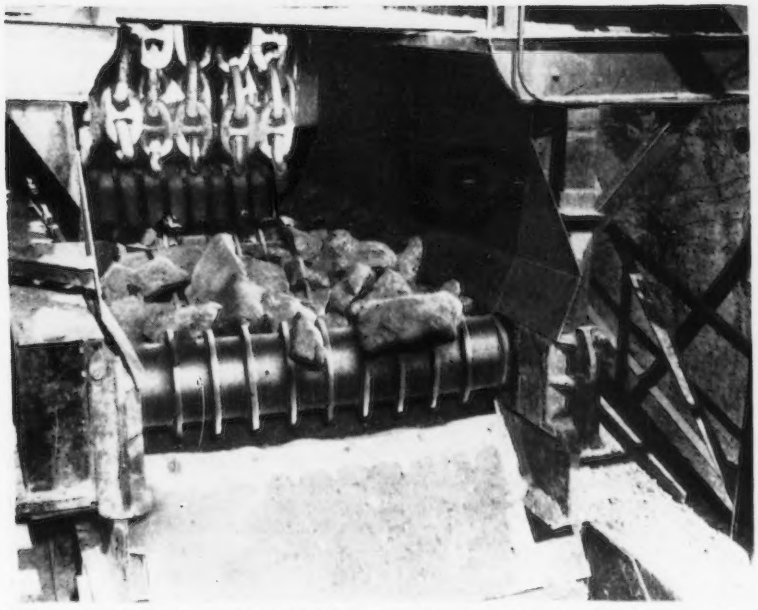
The feeder discharges onto some sort of a scalper. This may be either a stationary bar grizzly, a roll grizzly, or a heavy-duty vibrating screen. The opening used ranges from 2 to 6 in. or larger, depending either on the crusher setting or the minimum size rock which is to be rejected.

The coarse material in some ores consists mainly of taconite which has not been altered sufficiently to permit concentration by the processes used in these plants. Usually a by-pass is provided to enable the operator to direct the scalper oversize either to a crusher or to rock reject disposal. Rock rejects are handled either by a pan feeder or by a rock pocket with finger gates. The rock is hauled away by trucks and stockpiled in areas from which it may be reclamed in the future when means for concentration may be available. If it is desired to transport the rejects by belt conveyor, the reject by-pass is located following the primary crusher so that the rock may first be reduced to a size easily handled. At some properties, all scalper oversize is rejected and no primary crusher is used.

The primary crusher is, in almost all cases, a jaw type. The Blake type is in use at many of the older plants and in the larger new installations. The most popular in recent years, however, has been the overhead eccentric type for reasons of low first cost and force feeding characteristics. The 30x42-in. unit had been the largest available in the latter type until this year, when the 42 x 48-in. machine made its debut. Size of feed rather than crushing capacity usually has determined the crusher size.

The primary crusher product in some washing plants is fed onto a hand picking belt, or may be bypassed onto a rock reject belt, as already noted. Ordinarily this product and the scalper undersize are fed on to a belt conveyor to be taken to equipment for further processing. Often a buffer belt or steel pan feeders are used to cushion the fall of the ore onto the main conveyor belt.

The equipment mentioned up to this point is lumped together under the designation of "primary crushing and screening plant." In



THIS ELLIPTICAL-ROLL FEEDER, also known as the "wobbly" feeder, has recently been introduced. It is intended to replace both the conventional feeder and the scalper that follows it.

Minnesota's Lean Ores

many instances this unit is located near the bottom of the open pit to minimize truck haulage. A belt conveyor or a series of conveyors brings the ore out of the pit to the concentration section.

Treatment After Crushing

The character of the ore now determines which of the following treatments will be applied:

1. Direct shipment of merchantable ore.
2. Dry screening before direct shipment.
3. Washing
4. Scrubbing.
5. Jigging.
6. Heavy density separation.
7. Humphreys spirals.
8. Sintering.
9. Drying.

"Direct shipment" and "dry screening before direct shipment" are self-explanatory. Dry screening is done to separate the fines from the coarse material to permit them to be sintered before being fed to the blast furnace. To handle these ores dry requires very steep chute slopes because of their sticky nature, particularly where they are high in alumina.

Of the remaining processes, washing, jigging, heavy-density separation and concentration on spirals require wet screening and crushing to 1½ in. or finer.

Wash ores are ores having the contaminating silica in a fine state where it can be easily freed. Such ores are first wet-screened on a vibrating screen. The oversize is crushed in a reduction crusher, usually a cone-type. The crusher product is either rescreened or else washed in a log washer and then screened. The minus ¼-in. screen undersize and the log washer overflow (which contains the free silica washed from the ore) are fed to a rake or spiral classifier. The bulk of the silica is then discharged in the classifier overflow. The classifier rake (or spiral) product and the screen oversize are combined to make the wash ore concentrate.

Working on Jig Ores

This same circuit is used to prepare feed for other methods of concentration on the so-called "jig" ores, in which the silica is coarse or locked with the iron minerals. The screen oversize (plus ¼ in. or plus 3/16 in.) may be fed to either jigs or heavy-density equipment. The classifier rake product (minus 3/16 in. plus 65-mesh, approximately) can be fed either to jigs or to heavy-density cyclones. The classifier overflow (minus 65-mesh) may be deslimed and fed to spirals.

A scrubber is being installed at one plant this summer for the purpose of freeing the alumina from "painty" ore. The minus 3-in. crude ore will be fed with water to the Hardinge scrubber. The scrubber product will be screened. The undersize will be fed to screw classifiers, the rake product of which will be combined with the screen oversize as concentrate. Besides removing the alumina in the ore, this treatment will have the effect of lowering the moisture content.

If the ore is to be treated further by jigs alone, the screen oversize and the classifier rake product are combined for jig feed. At present, the Remco jig and the Conset jig are the only such machines in this service. Each type produces a tailing, a coarse bed concentrate, and a hutch concentrate. In one plant, four stages of Remco jigs are used. The first, or rougher, jig produces a finished tailing and a rough concentrate. The three jigs following clean up the concentrate and produce a middling which is ground in open circuit in a rod mill and fed back to the roughers. The concentrates are dewatered in classifiers before shipment.

High-Density Separation

The majority of plants now treating "jig" ores use high-density separation to treat the plus ¼-in. fraction. In most of the plants, the screen oversize from the crushing and washing section is given a final screening and washing on a horizontal screen before being fed to the high-density process. In plants of sufficient capacity to warrant the use of two high-density circuits, this preparation screen also serves to separate the ore at about 5/8 in. into a coarse and a fine feed.

A slurry of ferrosilicon and water is used as the medium for concentrating the plus ¼-in. (plus 3/16-in.) fraction. The medium is circulated at a gravity somewhere between 2.70 and 3.20, depending on the ore being treated. The two-circuit plant has the advantage of being able to operate with the circuit handling the finer feed at a lower gravity than the coarse circuit, thereby increasing recovery with no sacrifice in grade.

The cone-type Heavy-Media separator has been almost entirely

AGGLOMERATION is the final step in preparing fine ores and concentrates for the furnace. Here is one of the two Dwight-Lloyd sintering plants at present installed in Minnesota.

superseded by the newer types of separator. The Hardinge drum separator, the Akins screw separator, and the Wemco drum separator are the three types in general use. Each has its ardent supporters. A Roller separator is also being installed at one plant this summer.

High-density wash and drain screens are exclusively horizontal, single or double-deck, with either punched plate or wire cloth, Hendricks, Bixby-Zimmer, or wedge-wire decks, depending on the operator's preference. The latest trend is to combine the drain and washing functions on a single screen 20 ft. in length, and in widths up to 6 ft. A good many plants, however, still have separate wash and drain screens.

The Wilfley-type pump is standard for medium circulation, inasmuch as it requires no seal water and hence does not cause medium dilution. Several manufacturers have developed different types of pumps which require little or no sealing water. Several of these new types have been installed.

Magnetic Separators for Cleaning Medium

The belt type of magnetic separator is the most common in medium-cleaning circuits. Many drum-type magnetic separators have been installed in the past two or three years, often as secondary separators following belt-type primaries.

The coarse-size Heavy-Media plant produces three products: concentrate, which is ready for loading and shipping; coarse tailing, which is either stacked by conveyor or trucked away; and magnetic separator tailing, which is either returned to fines treatment or sent out with the fine tailings, depending on its grade.

Cyclones Enter Picture

Five plants are using Heavy-Media cyclones for treating the minus 3/16-in. plus 65-mesh fraction of the ore, with more installations of the same process in the planning stage. In general, the classifier product from the crushing and washing section described is further de-watered, then fed with circulating magnetite medium through a mixing chute into a pump sump. The ore-medium mixture is then pumped into a cyclone, or into two cyclones operating in parallel. The spigot product of the cyclone is sink or concentrate, while the effluent is float or tail. The two cyclone products are screened, a portion of the screen undersize is recirculated, and the remainder of the screen undersize is run through the cleaning circuit, which is a much modified version of the coarse Heavy-Media cleaning circuit. The concentrate and tails from the process are recovered as non-magnetic product from the magnetic separators.

More drum-type than belt-type magnetic separators are used in this application. An interesting development along this line is a proposed installation in which the secondary magnet drums will be mounted as an integral part of the product-dewatering classifiers.

Several plants are using jigs to treat the classifier product from the crushing and washing section, with either two or four cells in series. Remco, Pan American and Denver jigs are the machines being used in this application.

Spirals and Abrasion Milling

Humphreys spirals are used to treat the minus 20-mesh plus-200-mesh fraction. Hydroseparators, classifiers, or sizers are used to deslime the feed ahead of the spirals. The spirals are often used in conjunction with jigs or Heavy-Media cyclones to cover the range from ¼ in. to 200-mesh, in which case the top size to the spirals would be approximately 65-mesh. When used without other fines treatment, a screen is necessary to limit the top size of the feed to the spirals to about 20-mesh.

Abrasion milling, as practiced at several plants, is a useful auxiliary to these various methods of treating fines. Either the feed that goes to fines treatment, or else the middling from the fines treatment, is given a light pass through a ball mill charged with small balls. Silica adhering to the ore particles is abraded off, and coarse, friable pieces of silica are reduced to a size easily removed by fines treatment.

Two sintering plants are in operation. One plant uses Dwight-Lloyd equipment. The other plant uses both Dwight-Lloyd sintering and nodulizing.

One drying plant is in operation. It is on the Cuyuna range.

Provision for surge capacity ahead of the various processes has not been mentioned. Almost all plants have some type of surge capacity or storage ahead of high-density jigging, and fines treatment.

The majority of the new plants, and many of the older plants, have incorporated the most modern of electrical equipment, for safety and reliability. In most instances, all critical equipment is interlocked. Where possible, all machines in each section are controlled from one strategic location.

The management of these plants stresses safety in equipment and in operation, as is evidenced by the excellent safety record of the Minnesota ranges.

No two of these plants are exactly the same. Each has been built to fill a particular need. The research and operating personnel of each company are constantly on the alert and are ready to make any change which will increase the efficiency of their operations.

Portable Dry-Type Power Centers Offer . . .

1. Greater Operator Safety
2. Higher Machine Output
3. Lower Installations Costs

H. S. GATES
Member AIEE[1]

J. Z. LINSENMEYER
Member AIEE[1]

MODERN MINING EQUIPMENT requires a power distribution system that will: (1) Maintain proper voltage at the machine and (2) safeguard the operators. If mining machines are not operated at or near normal rated voltages, output drops and efficiency suffers.

Consequently the mine power center was developed to provide a portable unit that could be kept close to the machinery load and thus maintain good voltage regulation. A power center assembly consists of a transformer complete with secondary feeder breakers, low-voltage plug outlets, high-voltage plug, wiring compartment, skid; and when required, high-voltage breaker, grounding transformers and resistor.

For metal and non-metallic mines (where explosion-proof designs are not usually required) a ventilated case unit serves very well. This ventilated unit has terminal connections for 4-2½% taps on 4160-v. wye or 2400-v. delta windings; also space and accessibility to permit the low voltage to be series-parallel connected for 480 or 240 v. delta. Selection of the preferred voltage ratio is easily made by removing a bolted side panel and cover plate as shown in Fig. 4.

Ventilated dry-type transformers have given excellent service for more than six years in many different types of mines. In some places the dry-type unit has become the nucleus of built-up underground portable substations. Sometimes, however, these have proved a bit unwieldly to move. A typical unit is shown on p. 92.

The new unit is designed for compactness, so that it can be lowered in a relatively small shaft, about 45-in. x 45-in. Overall length is much less critical than height and width because the unit is designed to be lowered by one end as shown.

Transformer windings are Class B insulated and usually arranged as three single-phase units to obtain minimum overall height. Coils are supported by porcelain insulators arranged for changing tap connections. Impedances are from 2 to 4.2% to provide adequate short-circuit current limitation, and to give good regulation. Low losses produce high efficiencies at average operating load factors. Ratings are 112½, 150, 225, and 300 kva.

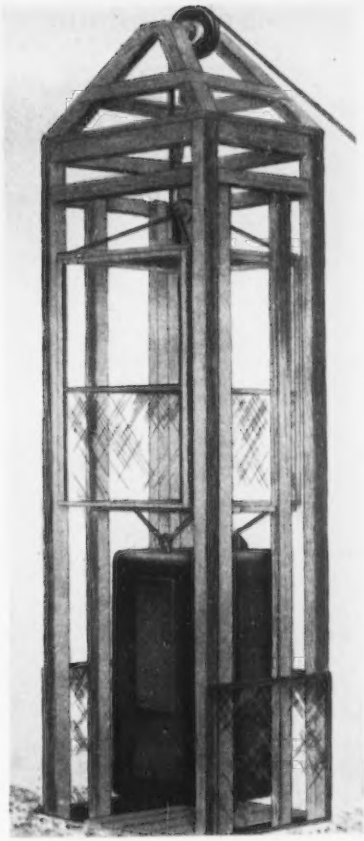
High Voltage Breaker

An oil circuit breaker (see illustration), may be provided in the high voltage end of the case. This breaker is rated at 5 kv, 100 amps. One side of the breaker is cable connected to an outlet gland for holding the four-conductor high-voltage cable or a three-pole disconnecting plug. The disconnecting plug may be sealed with a meter seal to prevent tampering. The breaker handle is accessible through a hinged door. The small amount of oil in the breaker must be checked before lowering the unit by one end.

The low voltage breaker housing is of standard panelboard construction with the breakers mounted in a vertical position. The panelboard is supplied with four de-ion, three-pole breakers with undervoltage, overload, and ground-trip mechanisms. The panelboard is located behind two hinged panels equipped with suitable locking handles. Breaker ratings are usually 225 amp., however, larger ratings are available but require such large secondary cables that portability is a problem. A fifth breaker, 50-amp., single-phase rating, is also mounted on the panelboard to supply a 120-v. lighting circuit.

The power center assembly has been standardized to give the following dimensions for the 112½, 150, 225, and 300-kva units: Height, 36¼ in.; length, 104-in.; width 44¾ in. for the first three sizes, and 45¼ in. for the 300-kva. unit. Weights are 3000, 3450, 4100, and 4450 lb., respectively.

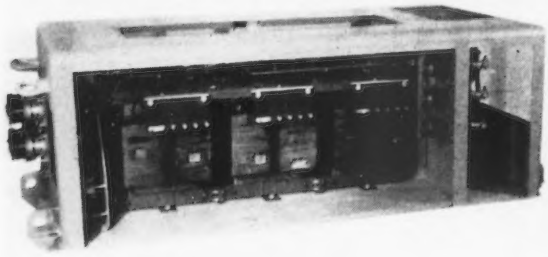
The unit is compact, with all live parts entirely enclosed in a case with protected ventilating open-



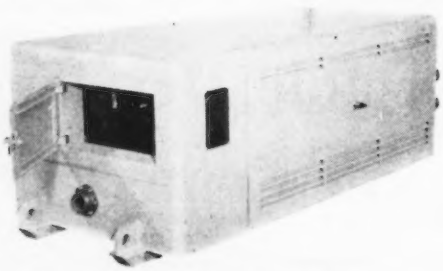
COMPACT—PORTABLE
Portable dry-type units like this can be lowered in a 45 x 45-in. shaft compartment for mine installation.

[1] Article based on material in a paper presented by the authors at the AIEE Pacific Coast General Meeting sponsored by the AIEE Committee on Mining and Metal Industry.

The elements of a good portable dry-type mine power center

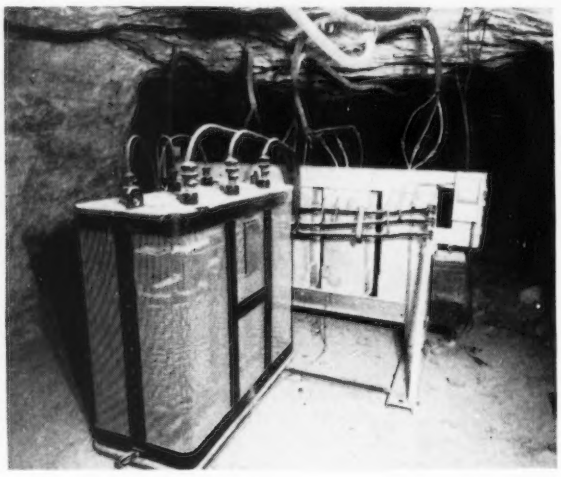


VENTILATED TRANSFORMER enables operator to select desired voltage ratio by removing bolted side panel.



OIL CIRCUIT BREAKER, rated at 5 KVA, 100 amp. is easily accessible through hinged door at end of unit.

AIR CIRCUIT BREAKERS automatically clear high overloads, ground faults, and short cricuits in the mine power system.



DRY-TYPE TRANSFORMER has become the nucleus of a portable substation built up and assembled underground.

ings. The ac mine power center may be handled on rails by the use of special cars or dollies having rail gage from 24 to 48 in. These cars are 15 in. high. The unit may be located in a mine near the mining machines and thus maintain proper voltage on the motors.

Low Voltage Breakers

Air circuit breakers used with mine power centers are manually operated but open automatically to clear high overloads, ground faults and short circuits. They are shown above. Instantaneous magnetic trips operate the breakers within $\frac{1}{20}$ to $\frac{1}{30}$ of a second. The breakers can be reset readily to return power to motors and lights after the trouble has been removed. They are available in 100 and 225 amp. continuous ratings which will safely interrupt fault currents of 15,000 amp. and 600 amp. continuous rating with 25,000 amp. interrupting ability.

Cable outlets are provided for four machines. Each outlet contains a pilot safety circuit. Three polarized pin contacts are provided for the power line and two for the safety circuit. The undervoltage trip coil of a load breaker opens the breaker when the pilot circuit is broken by pulling out one of the plugged connectors on the cable. The undervoltage trip coil also trips the breaker if the cable is cut accidentally. This automatic tripping prevents damaging and hazardous arcing at the plug connectors if they are inadvertently opened while the unit is loaded.

Underground Circuits Are Dangerous

A schematic diagram of a three-phase ungrounded system is shown on p. 93. If a fault occurs in one phase "F_1" to ground, there will be no interruption in service and the system may continue to operate without indicating that a fault exists. If a second fault should occur between another line and the frame of a machine, it will produce a short circuit and the current will flow through the machine and earth to the other ground. Magnitude of current will depend on the impedance of the circuit.

Contact resistance to ground may be quite high and limit the fault current to a value too low to trip the breaker.

Voltage impressed on the fault circuit will be divided in proportion to the impedance of the different elements in the circuit, and if the contact resistance to earth is high, practically full line to line voltage may exist between the frame of the machine and ground. Consequently an operator coming in contact with the machine may be very severely shocked. By the use of a good grounding system and proper electrical equipment this hazard of electrical shock to the machine operators can be reduced to a practically negligible factor.

Grounding Eliminates Danger

Schedule 2E of the U. S. Bureau of Mines states, "It is recommended that an adequate ground be provided for all machine frames. The frame of a portable machine which receives power from an external

source and which cannot be considered as being in intimate electrical contact with the earth as when resting on timber or mounted on rubber tires, shall be adequately grounded. The power conductor shall not be used for grounding."

A Safe Grounding System

A recommended safe grounding system is shown at right. This system limits the voltage that can exist between the unit and ground by use of a relatively low resistance ground wire, and ground fault current-limiting resistor inserted between the ground wire and the neutral established by a zig-zag connected transformer. The resistor limits the maximum fault current that can flow in the ground wire to 5 amp. Under fault condition the major portion of the line voltage will appear across the resistor and the voltage that can exist between the machine and ground will be limited to the voltage drop in the ground wire which is equal to the maximum current (5 amp.) multiplied by the resistance of the ground wire.

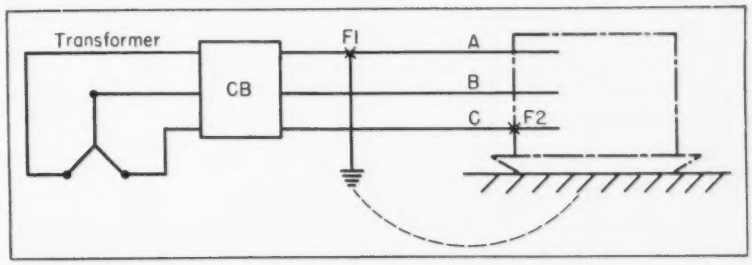
Special ground current trip coils are furnished as standard items on the secondary feeder circuit breakers of the mine power center arranged for connecting in the ground-wire circuit as shown. These coils will open the breaker when the ground-fault current reaches 3 amp., but they have sufficient capacity to carry the maximum fault current of 5 amp. continuously.

They provide the choice of 4160/2400-v. primary and 480/240-v. secondary, the mine power center transformer is commonly supplied with wye-connected primary for 4160 v. which can readily be reconnected to delta for 2400-v. and a delta-connected secondary which can be connected for either 440 or 220 v. Since the delta low-voltage does not provide a neutral, the power center unit can be supplied complete with the zig-zag grounding transformer arranged on the low-voltage side to provide a neutral point for grounding the circuit as shown in the diagram on this page.

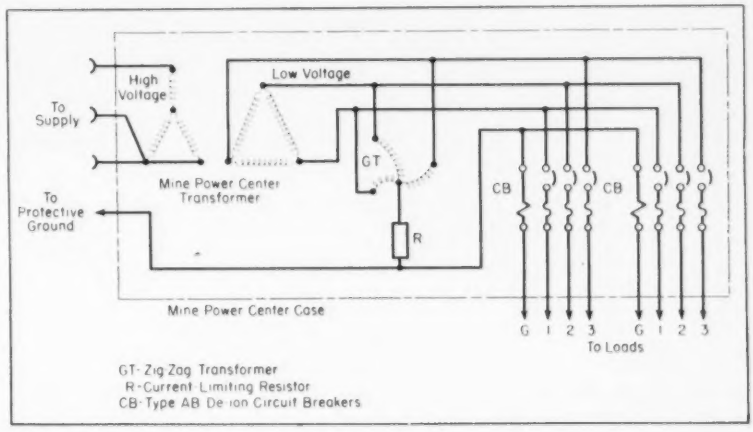
The high-voltage line feeding the primary should also be grounded at the substation, and the same reasons for limiting the maximum ground-fault current discussed above apply on the high-voltage side. However, because of static unbalance or leakage it is quite possible for a 25-amp. ground current to flow in the ground wire even though a fault does not exist. Also, it is necessary that the circuit be cleared if a high impedance should be present which would hold the fault current to a value much lower than the maximum determined by the grounding resistor. Therefore, on the high-voltage side it is customary to use a resistor designed to limit the maximum ground-fault current to 25 amp. with relays which may be adjusted to trip in the range of 6 to 25 amp.

It is recommended that frequent checks be made to insure continuity of the ground wire on both the high and low voltage sides for protection of both equipment and personnel.

How to safeguard equipment operators



UNSAFE. **This three-phase system is unsafe because it is ungrounded. If a fault occurs in one phase F_1 to ground, there will be no interruption in service, and no indication of a fault may exist. If a second fault should occur between another line and the machine frame, it will produce a short circuit, and the current will flow through the machine and earth to the other ground. The contact resistance may be quite high and limit the fault current to a value too low to trip the breaker. Under certain conditions, an operator coming in contact with the machine may be severely shocked.**



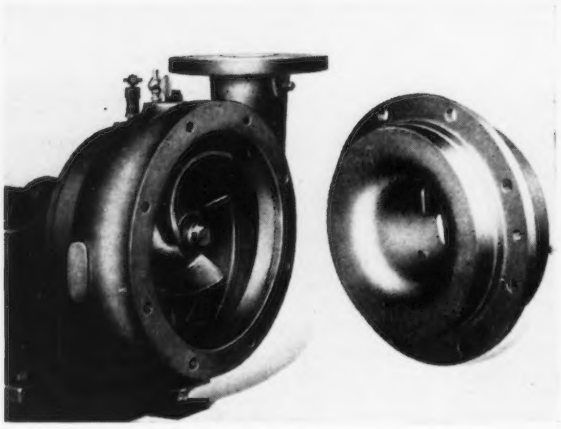
SAFE. **This is a safe grounding system, conforming with the U.S. Bureau of Mines recommendations. This system limits the voltage that can exist between the unit and ground through use of a relatively low resistance ground wire, and ground-fault current-limiting resistor inserted between the ground wire and the neutral established by a zig-zag connected transformer. The resistor limits the maximum current that can flow in the ground wire to less than 5 amp. Special ground-current trip coils will protect the operator from shock in case faults occur.**

Conclusion

Compact portable mine power supply units now offer these advantages for mine operators:

(1) Safety to the operators through a complete voltage limiting circuit during fault conditions. (2) Low installation costs because a power center requiring only that the cables be plugged in to put in operation, without the necessity of building permanent rooms or vaults. (3) Maximum production afforded by normal motor voltage available at the machine. (4) Flexibility of movement. Only a single piece of portable equipment has to be moved forward to the mining face.

CLOSED IMPELLER, left, with pump casing. Radial clearance replaceable wearing ring is shown.



OPEN IMPELLER is seen. Contour of special suction cover matches shape of edge of impeller vanes.

Should I Specify Open or Closed

The latter are preferred with certain exceptions

J. A. CABLE
Application Engineer
Norwood Pump Section
Allis-Chalmers Mfg. Co.

WHAT SHALL BE THE CHOICE, open or closed impeller? Here's a situation to which the old adage, "there's a time and a place for everything" should be applied more frequently. Each impeller type has its advantages and there are several good reasons why one or the other will be the better choice for any centrifugal pumping application.

Generally speaking, closed impellers are a better choice in more cases than the open-type. The easiest way, therefore, to set up a rule of thumb is to establish that closed impellers are preferred with certain exceptions.

The first consideration concerns the impeller's physical proportions. This is well established by the rating the pump was designed to produce. The problem is usually encountered in this form when pumps of comparatively small capacity are under consideration. Foundry technique makes it inadvisable to attempt to cast closed-type impellers unless the water passages are equal to or in excess of the limits set forth in the accompanying table.

This, of necessity, is not a cut-and-dried limitation, as it will vary somewhat with various foundries, but it can be roughly considered as an index to such limits. Closed impellers can be cast with smaller passages but will be extremely difficult to clean.

The point is, however, that if the impeller passages are larger than these minimum measurements, the pump (if of the open-impeller type) has been designed for the manufacturer's convenience and to reduce its first cost thereby. This is important but don't overlook the fact that, particularly in corrosive services, where there are abrasives in suspension, there is every chance of this being false economy.

Most pumps intended for certain mining services that are offered as standard with open impellers and without closed-impeller possibilities are not up to par in overall design. That is, the open impeller does not have a companion replaceable wearing surface. After wear takes place to any degree, it becomes necessary to replace major parts, such as impellers and casings or suction covers. With closed impellers and replaceable companion wearing parts, it is possible to renew clearances occasionally and maintain much better overall performance for head capacity and efficiency. Sideplates with special, contoured surfaces are often used with open-impeller designs, or the mating surface of the casing or suction cover has a special, fitted shape. This is not a desirable arrangement for abrasive services since it is unlikely that the wear will be sufficiently uniform to permit much adjustment.

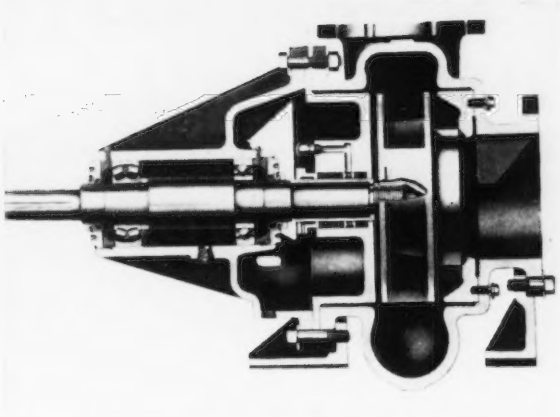
Size of Water Passage

Material	Approximate Width of Opening Between Sidewalls (Min.)	Approximate Impeller Diameter (Max.)
Bronze	1/8 in.	6 in.
	1/4 in.	12 in.
Stainless steel	1/8 in.	Not practical
	5/16 in.	6 in.
	1/4 to 3/8 in.	12 in.

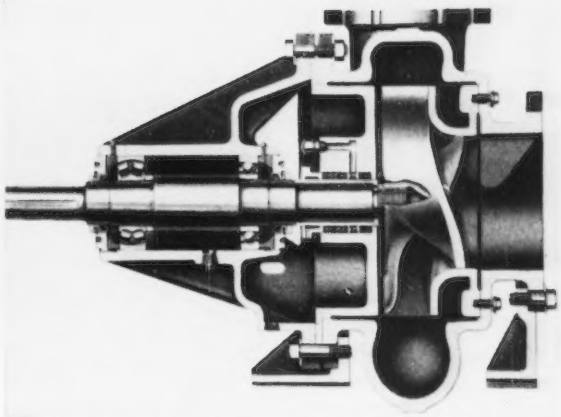
Use Closed Impellers With Certain Exceptions

Actually, on the basis of good hydraulic design, closed impellers should be used when they are of suitable physical proportions, unless one of the following conditions exists in the application:

1. The liquid handled tends to build up a coating or scale on the surface of the pump interior. This coating on the impeller sidewalls will progressively restrict the flow through the passages and thus reduce the output accordingly. Such a scale might also cause binding of wearing surfaces, especially if the clearances are between radial ring fits. Open-type impellers will, in part, be self-cleaning in such an instance and will be less susceptible to binding. Also, open impellers can

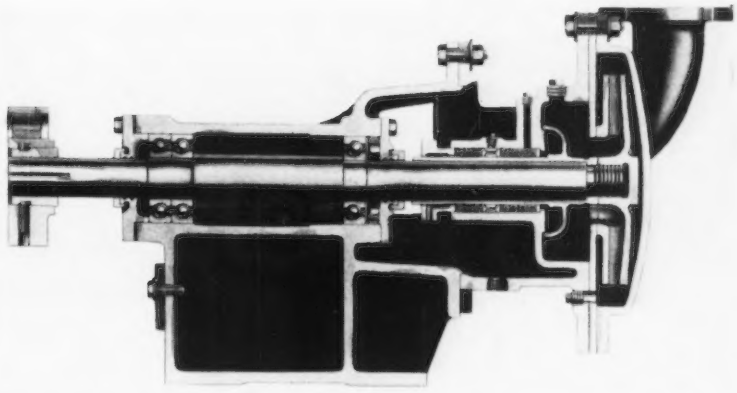


CLOSED IMPELLER shown in sectional view has replaceable and clearance wearing plate.



AN OPEN IMPELLER is seen in this cross-sectional view. A replaceable wear plate is provided.

Impellers?



PROCESS PUMP with axial clearance ring fit and suction on shaft side to minimize pressure on stuffing box.

be cleaned more easily when this becomes necessary. This is especially true if cleaning is done by scraping or an acid-bath treatment.

2. If the solution carries large solids in suspension which are bigger than the passages between the vanes and these solids tend to break up when manipulated, the open impeller has a distinct advantage. There is every possibility that such solids will pass through open-impeller pumps, whereas they would clog closed-type impellers.

Concerning the second point, it is well to be reasonably sure that the solids will break up when handled. Certainly it is far better to have an occasional oversize piece plug up a closed impeller than to have an oversized solid get wedged between the impeller and the casing or wearing plate and very rapidly increase the clearances with a correspondingly rapid decrease in capacity and efficiency.

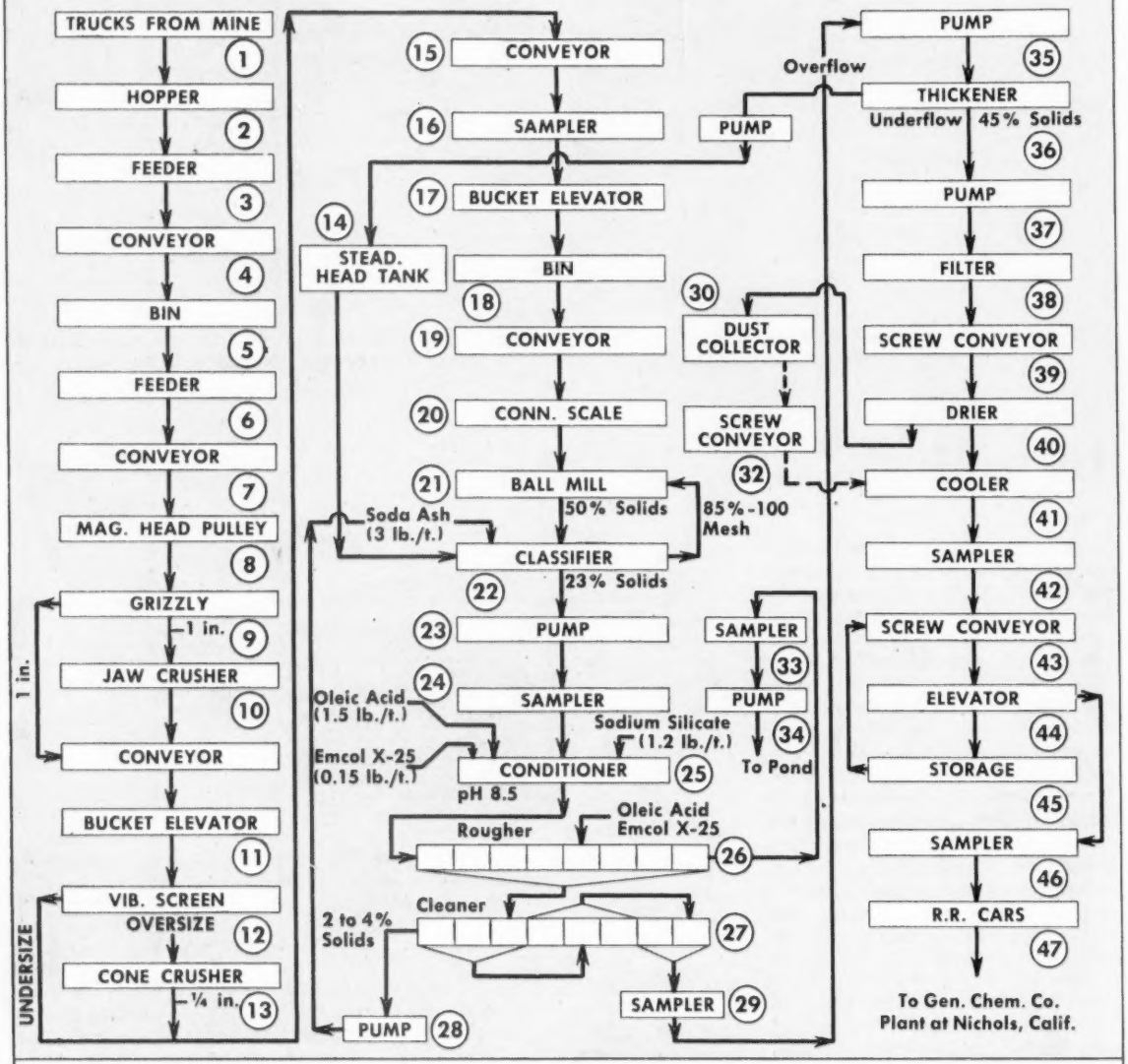
Closed Type Better Even for Abrasive Solutions

It has long been the opinion that open impellers should be used for handling abrasive solutions. Invariably, this is false reasoning, since open-impeller pumps are probably of inferior design which may result in lower first cost but will definitely give a less desirable maintenance record—less desirable both in cost of replacement parts and in loss of production due to shutdown time for maintenance. With open impellers, the wear along the edges of the vanes reduces the width of the vane and respectively cuts down on the pump's capacity. Of course, with clear liquids this may not be of major importance but if the liquids are laden with abrasive particles, it is very important.

Even with softer, less abrasive solids such as paper stock, it has been found economical to employ closed rather than open-type impellers. Actually with such services the problem evolves about the type of wearing clearance used with closed impellers more than it concerns open versus closed impellers themselves. With radial clearance wearing fits, it is practically impossible to have the rotating member revolve in a true central orbit and the clearance, instead of being uniform about its circumference, is actually a continuous wedge shape. Fibrous materials will gradually build up until binding occurs. If the clearance is of the axial type, there is no enclosure into which these fibres can be packed and no binding difficulties are experienced. Also, with axial wearing clearances, provision can be made for adjustment of these clearances to extend the original rating as to head, capacity and efficiency over longer operating periods.

In this article, we have set forth some factors worthy of consideration when selecting impeller types for pumping liquids with solids in suspension. In very small capacity units, there often is no choice, because casting limitations make open impellers a necessity. However, on units of medium and larger capacity, consideration of these factors can result in a more economical selection of centrifugal pumps.

FLOWSHEET OF 100-120-TON KAISER FLUORSPAR MILL FALLON, NEVADA



LEGEND

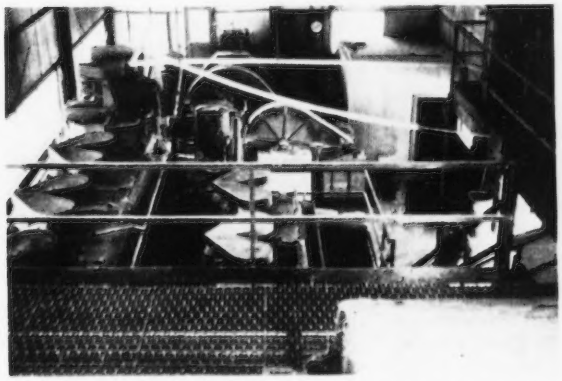
1. 20-ton Peterbuilt trucks
2. 30-ton hopper
3. 30-in. by 6½-ft. S-A reciprocating plate feeder
4. 24-in. belt conveyor 160 ft. C.C.
5. 200-ton bin
6. 30-in. by 6½-ft. S-A reciprocating plate feeder
7. 24-in. belt conveyor 34 ft. 7½ in. C.C.
8. Stearns 24x24-in. magnetic pulley
9. Steel grizzly, spaced 2½ in.
10. 10x20-in. Pacific jaw crusher
11. Chain elevator, 8x5-in. buckets, 25 ft. C.C.
12. 3x6-ft. Overstrom vibrating screen
13. 2-ft. Symons cone crusher
14. Steady head tank
15. 24-in. belt conveyor 32 ft. 4 in. C.C.
16. Denver automatic sampler
17. Chain elevator, 8x5-in. buckets
18. 150-ton bin
19. 20-in. conveyor 18 ft. 7 in. C.C.
20. Trans Weigh conveyor scale
21. 5x5-ft. Denver ball mill
22. 30-in. by 17-ft. 6-in. Wemco 9-H classifier
23. 2-in. Wemco sand pump
24. Denver pulp sampler
25. Wemco conditioner, 18-in. propeller
26. Denver 8-cell No. 18 rougher machine
27. Denver 8-cell No. 18 cleaner machine
28. 1½-in. Wemco sand pump
29. Denver pulp sampler
30. Western Precipitation dust collecting system
32. S-A screw conveyor
33. Denver pulp sampler
34. 2-in. Wemco sand pump
35. 2-in. Wemco sand pump
36. Denver thickener
37. Wemco diaphragm pump
38. Denver 4x3-ft. drum filter
39. S-A screw conveyor
40. 5x50-ft. dryer
41. Western Precipitation Holoflite cooler
42. Denver sampler
43. S-A screw conveyor
44. Bucket elevator, 8x5-in. buckets
45. Concentrate storage
46. Denver sampler
47. Railroad cars with covered hoppers

STEEL HEADFRAME features built-in sorting plant. A 4 x 10-ft. Symons vibrating screen with 2½ x 1-in. openings feeds oversize to picking belt. Dumped ore is deflected from chute to screen by swing gate.

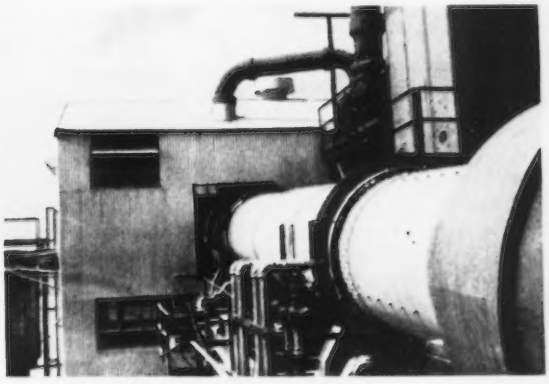
Kaiser Streamlines Mining and Processing of Nevada Fluorspar

ALTHOUGH FLUORSPAR HAS BEEN mined from the Kaiser mine (formerly known as the Baxter) in Mineral County, Nevada, for more than 35 years, the early operations, aimed at mining high-grade material led to many comparatively shallow underground workings that closely reflected the distribution of the richest fluorspar concentrations. Systematic development and mining was started soon after Kaiser Aluminum & Chemical Corp. acquired the property in February, 1952. Today, more than 100 tons of ore daily is trucked to the company's mill at Fallon, Nev., 73 miles away where a concentrate assaying 98.5% CaF_2 is produced for subsequent conversion into aluminum fluoride.

The mine is developed on four levels at roughly 100-ft. intervals on the incline, with a fifth level



FLUORSPAR MILL produces a concentrate assaying 98.5% CaF_2 from mill heads that average about 40%.



ROTARY KILN, 5 x 50 ft., dries cake and drives off oleic acid added in concentrating plant.

under development at 600 ft. incline depth. The 400 level is the main haulage level. Four shafts serve the mine. Shafts 1 and 3 are used for ventilation exclusively; some timber and supplies are lowered through shaft 4. Men, some supplies and all production are handled in shaft 2. This opening is sunk on an incline of 52 deg. and contains a 5x4-ft. hoisting compartment and a 2½x4-ft. manway. It extends below the new 600 level, with a pocket at 675 ft.

The 65-ft. steel headframe at No. 2 features a built-in ore sorting plant using a 4x10-ft. Symons vibrating screen with 2½-in. square openings for removing coarse waste, from which lumps of fluorspar are hand sorted. The 2-ton skip powered by a 150-hp. diesel-driven hoist is dumped automatically into the main steel chute to the combination waste-ore storage bin below. A swing gate deflects ore to a screen. Screen undersize goes directly to the storage bin and oversize to a slow-moving picking belt. The sorting unit has meant considerable savings in both transportation and milling. The storage and loading bin contains two compartments, one capable of holding 120 tons of ore and the other 40 tons of waste.

Ore occurs as fissure filling in andesite. General strike of the main vein system is NE-SW, and dip 52 deg. SE. On the southwest end of the property there is a vein diverging at about 35 deg. from the main vein. The major fault occurring at the extreme northeast end has not yet been thoroughly prospected. Both foot and hanging walls in the southwest end of the property have been tentatively designated as blocky andesite, and those in the northeast end as rhyolite flow rock. The southwest end of the mine contains the large vein section.

Mining Methods

Current development drifts, 7x9, ft., are advanced with both I-R Jackhammers with Jacklegs, and Copco drills with Coromant steel with chisel bits, and are mucked with Eimco 12-B Rockershovels. Blocked out ore is mined by shrinkage stoping in the newly opened parts of the mine and by underhand shrinking stoping in the old stoping areas. In previous stoping operations only high-grade portions of the vein were removed, leaving widths and extensions minable under present conditions. These are blasted in benches into the open stope until a floor has been established near the advancing bench. After this the ore is withdrawn to depth of the next bench to be drilled and blasted. Where quantity flow is impossible, broken ore is transported to draw points by scraper assemblies made up of I-R slusher hoists and 27-in. Pacific "Slushmaster" scrapers. The bulk of production is obtained from the 200, 300 and 400 levels. On the main haulage level, the 400, ore withdrawn from storage points is loaded into 1½-ton rocker-type cars and hauled to the shaft pocket. As the mine makes little or no water, no pumping is done underground and since the ground is not heavy, only a limited amount of timbering is done. The blocky nature of the ground, however, demands extreme care in the old stopes. At points requiring support, round stulls and roof bolts are used. Mine production is trucked to the mill at Fallon, a distance of about 73 miles.

Reduction Plant

The mill was put in operation in September, 1952. The flowsheet (p. 96) was worked out by the engineering staff of Kaiser Aluminum. Western-Knapp Engineering handled the general layout and supplied most of the equipment. Detailing and actual construction were done by Kaiser Aluminum. As built, the plant is one of the most modern in existence, with the latest labor-saving facilities incorporated in its design. All buildings are of steel-frame construction covered with corrugated aluminum sheets, and ventilation provides pleasant working conditions during both summer and winter.

Ore delivered from the mine in 20-ton trucks to the discharge ramp at the head of the crushing plant consists of minus 2½-in. material and hand-sorted lumps of fluorspar ranging in size from 2½ in. to 10 in. Mill heads assay about 40% CaF_2. Material drawn from the 30-ton storage hopper by a reciprocating plate feeder is reduced to minus ¼-in. ball mill feed in two stages, first in a jaw crusher and then in a cone crusher preceded with a vibrating screen with ¼-in. openings. Grinding to 85% minus 100 mesh is done at 50% solids in a ball mill operating in closed circuit with a spiral classifier. The soda ash is added dry to a special vessel with hot water and the solution added to the cleaner tailings and pumped to the classifier. This practice has cut soda ash consumption by about 50% (now 3 lb./t.) of that used when adding it ahead of the ball mill.

Classifier overflow is pumped at 23% solids to a conditioner receiving oleic acid (1.5 lb./t.) and Emcol X-25 (0.15 lb./t.) mixed, and sodium silicate (1.2 lb./t.). A pH of 8.5 is maintained at this point. Rougher flotation is carried out in an 8-cell Denver Sub-A flotation machine with a mixture of oleic acid (75 lb./t.) with 10% Emcol X-25 added to cell 5. The Emcol X-25 acts as a dispersant for the oleic acid. Resultant rougher concentrate is cleaned in an 8-cell cleaner machine, with cells 7 and 8 producing a final concentrate assaying 98.5% CaF_2. Flotation recovery is above 95%. Rougher tailings are pumped at 10 to 15% solids to the tailings pond, while cleaner tailings are returned to the classifier for makeup water. Cleaner tailings do not require regrind. In view of the fact that the cleaner tailings are quite dilute they cannot be returned to the conditioner or rougher flotation machine because of the danger of lowering flotation density to a point where sanding could result.

Finished concentrates are thickened to 45% solids with the underflow treated in a drum filter and the overflow pumped to the steady-head tank furnishing water for the grinding circuit. The filter cake containing 8 to 12% moisture is dried in an oil-fired rotary dryer where oleic acid is driven off. In the dryer a product discharge temperature of about 600 deg. F. is maintained, and waste gases leave the feed end at about 375 deg. F. From 3 to 4 gal. of P.S. 300 oil is burned per ton of concentrate dried.

Waste gases are handled in a Western Precipitation dust collecting system consisting of Multiclone and bag collector units. Dry concentrates, after passing through a cooler, are elevated to the storage and loading bins. They are shipped in covered hopper cars to General Chemical Co.'s plant at Nicholls, Calif., for conversion into aluminum fluoride and subsequent use in Kaiser Aluminum's pot lines.

Personnel

H. D. Phillips, general superintendent, directs operations both at the mine and reduction plant. Staff members at the mine include R. C. Kirchman, superintendent, and P. W. West, mine foreman. Assisting Mr. Phillips at the reduction plant are W. D. Johnson, mill superintendent, G. R. Frayser, chemist, and H. F. Mayhew, accountant.

Unit Copper Production Costs Increase in Foreign Mines

W. F. BOERICKE
Consulting Engineer
New York

PRODUCTION COST per pound of copper is seldom divulged by domestic copper producers. There are a few exceptions. Magma Copper Co. has regularly informed its stockholders of its production cost for more than a decade. A few other companies, like Miami Copper, without actually stating their unit costs, furnish enough salient figures so that with a little arithmetic and a modest use of a slide rule, the inquisitive stockholder can obtain the cost per pound himself. Unfortunately few stockholders take the trouble to do so.

The beautifully illustrated reports of the major producers, however, maintain a sphinx-like silence on their production costs. For this reluctance there are some obviously good reasons. Their operations may be so diversified as to make the cost of producing any single metal meaningless. The importance and variety of the byproduct metals recovered with copper constitute credits which may be considered to reduce the unit cost of copper accordingly. The fully integrated copper companies may find it impolitic to disclose their unit costs without including fabricating costs as well, hence are content with an income statement in which costs of producing copper are combined with all other costs of manufacturing, fabrication, selling and administration so that any segregation becomes impossible.

Major foreign copper producers, however, are in a better position to disclose unit costs. Usually the value of byproduct metals recovered is substantially less than for domestic copper mines. Their operations generally are not integrated and are confined to straight copper metal production, with the end product either blister or refined metal.

Some instances may be cited that have especial interest because of the commanding position such companies hold in world copper production and the strong competition they may be expected to offer in world markets, under normal conditions.

Of prime interest are costs in Chile and Northern Rhodesia, which produced approximately 15 and 11% respectively of world copper output in 1952 and bid fair to exceed these ratios in the years ahead.

Chile and Roan Antelope

The unit cost per pound of copper by the Chile Copper Co. can be approximated closely from the annual report of the company. Exact figures are given for cost of deliveries, which generally are not far removed from actual production. Thus in 1952, production was 350,902,772 lb. of copper against deliveries of 338,288,965 lb, a discrepancy of about 3%.

On this assumption, that production approximates delivery, the unit cost in 1952, for operating expenses, development, maintenance and repairs, administrative, selling and general expenses and taxes, except income taxes, was $0.139 per pound. Depreciation and interest on notes increased this to $0.152 per pound. Provision for U. S. and Chilean income taxes raised this to $0.199 per pound.

The unit cost for Chile Copper Co., ex-income taxes, has more than doubled since 1945, as shown in the tabulation that follows:

Year	Cost of Deliveries (Per Lb. Copper)
1945	$0.063
1946	0.078
1947	0.091
1948	0.115
1949	0.125
1950	0.116
1951	0.131
1952	0.139

Roan Antelope Copper Mines Ltd., a major producer in the Northern Rhodesian field, may be accepted as representative of the other mines in that area. In the fiscal year ended June 30, 1952, the company produced 81,027 long tons of blister copper, or 90,750 short tons, from milling 4,368,000 tons averaging 2.4% copper.

Unit costs have risen steadily since 1946, as shown in the table. Costs include mining and transport, milling, smelting, general expense, mineral royalty, administration and sales service, and freight to Beira.

Year	Total Cost, f.o.b. Beira (Per Lb. Copper)
1946	$0.053
1947	0.065
1948	0.083
1949	0.088
1950	0.091
1951	0.101
1952	0.113

Costs for both Chile Copper and Roan Antelope increased in nearly the same ratio between 1946 and 1952, with 120% increase for Chile Copper and 113% for Roan, in spite of wide differences in character of labor and operating conditions.

O'okiep Copper Co., Ltd., in Africa, produced 23,622 tons of blister in 1952 from milling 972,200 tons averaging 2.43% copper. This is about 26% of Roan's output in the same year. For fiscal year 1952, unit operating cost at the mine works out at 9.5 cents per pound blister, before freight, sales, and delivery expense ex-mine of about 1.5 cents per pound. This cost of 11 cents is exclusive of depreciation, depletion and income taxes. It compares with 9.2 cents per pound in 1951 and 8.3 cents in 1950 before deducting the same charges.

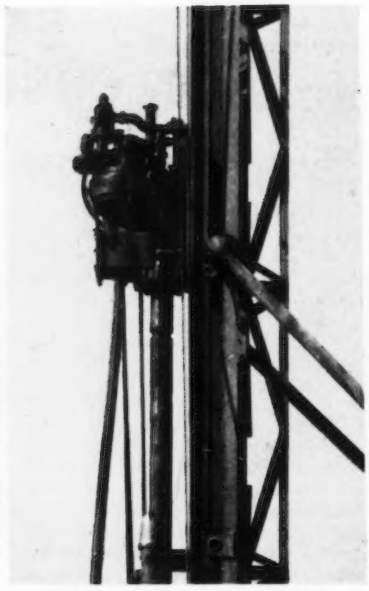
Lepanto's Cost

On the other side of the globe is Lepanto Consolidated Mining Co. which operates the major copper mine in the Philippine Islands and accounts for over 96% of the total copper output of the Republic. Production in 1952 came to 13,213 tons, and direct operating cost, which includes mining, milling, marketing and general overhead is reported by the company at 0.371 peso per lb. ($0.185). This was before depreciation, depletion, production tax and income tax.

Lepanto takes no credit for its very substantial production of by-product in reporting its unit copper cost. It is usual to deduct such a credit in reporting the cost of copper. If this is done, a credit of 0.14 peso ($0.07) per lb. copper is established, which would reduce the cost of copper to about $0.115 per lb. The grade of ore milled in 1952 was 3.9% copper.

It is interesting that the four instances cited of foreign copper producers show costs within so close a range. It should be pointed out that these costs are not inclusive of costs of ocean freight to consuming points nor do they include refining costs, which will probably add about 2½-3½ cents more. (Lepanto costs are an exception, as marketing is included). It should also be noted that in each instance the grade of copper milled is substantially higher than the average grade for U. S. copper mines, hence any comparison with domestic costs would be unfair if taken as an unqualified index of operating efficiency.

KEEPING TAB ON PRACTICE



SURPRISING to many readers will be this Quarrymaster drill equipped with air-operated rotary head and Hughes Tri-Cone roller bit for putting down holes in softer, less abrasive material. The Quarrymaster has been known hitherto for its work in hard abrasive rock as an air-driven percussive-type drill using four-point carbide-insert Carset bits of 5½-, 6-, and 6½-in. diameter. The new machine can be readily converted from one type to the other, giving all-purpose drill. At right, ROTARY HEAD close up.

One Drill for Percussive Drilling and Rotary Drilling

ABILITY TO DRILL in hard, abrasive ground as a percussive machine with Carset carbide bits or in softer, less abrasive ground as a rotary machine with Tri-Cone roller bits features Ingersoll-Rand's new Quarrymaster machine shown in the accompanying pictures. Lane Construction Co., Meriden, Conn., is operating this drill on the New York Thruway, near Batavia, N. Y., drilling holes 16 to 42 ft. deep. Spacing is 19-22 ft. and burden 16-17 ft.

The W7R Hughes bit, 6¾ in. in diameter, is being used. This bit is specified for hard, abrasive rotary ground. The ground on this job is on the borderline, so far as choice of rotary or percussive drilling is concerned.

Overall drilling rate, including all relays, is approximately 18 fph, the actual rate varying from 15 to 30 fph. Total bit life is 400 to 500 ft., a low figure compared with what could be obtained with percussive drilling in this ground.

The drill is equipped with a Vaposol dust-collection system, required by the State of New York for suppression of fine dust particles. It was operating at the time the accompanying photographs were taken.

Drilling Down Under Follows Familiar Lines

GREAT CHANGES IN DRILLING procedure are taking place in underground mines in Australia, according to a summary of mining practice presented to the recent Fifth Empire Mining and Metallurgical Congress for Australia and New Zealand. Three factors are mainly responsible:

1. Vast improvements in manufacture of tungsten carbide for percussion drills and in its attachment to high-quality bits or to alloy-steel rods.

2. Introduction of hydraulic rigs for mounting heavy drifters in development headings.

3. Use of the airleg with the jack-hammer to form a general-purpose rock drill.

The Trend in Equipment

Rock Drills in Development Work—For level headings, stripping and excavations generally on levels, the standard column-and-arm mounting of 3-in. and 3½-in.-dia. hand-cranked drifters with fixed-cone mountings was formerly in general use. Columns and arms in many cases are still used, but sliding cones are now universal. Cradles, too, are changing and the tendency is towards longer travel—up to 72 in. Hand cranking has been replaced by air-driven, power-feed motors. Jumbo mountings for two, three or four machines in metal-mine main headings and much larger ones in railway and water-supply tunnels, have largely replaced the simple column-and-arm rig. These in turn have given way to hydraulic rigs mounting one or several machines. The hydraulic rig is particularly suitable for drifting where a standard round resulting in a one- or two-shift sequence of work is possible or can be made so because of the simplicity and speed of setting up and changing the position of the drills.

Improvement in the airleg has led to its use with the light jackhammer and the combination of the two as a general-purpose rock drill.

In driving raises, the telescopic

stoper has long since replaced the mounted drifter. The principal changes are the application of water feed through hollow steel and a rotating chuck. Where raises are flat, the jackhammer-airleg combination has been found preferable.

For sinking winzes, changes in valve design of the sinker or jackhammer have produced more reliable and faster machines without altering appreciably the original design. Generally, the heavier machines are favored in shaft sinking, but winzemen, working usually in a smaller space, will always prefer the lighter 55- to 60-lb. tool, and use it with one or both arms of the handle removed.

In shaft sinking, preference has been shown for light jackhammers and alloy steel with integral tungsten-carbide inserts.

Drills in Stoping—The choice of drilling equipment may depend much upon the type of orebody and the condition of the lode walls, either or both of which decide the method of mining. For instance at Mount Isa, in Queensland, and at Big Bell, in Western Australia, where the orebodies are extensive and have walls that stand well, sublevel stoping is practiced with long-hole drilling. Stope development and stripping to form the bells are done with column-mounted, power-feed drifters or with light jackhammer and airleg combinations. The advent of carbide detachable bits may introduce a further change and long-hole drilling with column-mounted drifters is being investigated.

In conventional horizontal cut-and-fill stoping, with or without timber, the column-and-arm-mounted drifter has until recently been used almost universally. Usually, horizontal holes, in addition to the reaching forward effect which is important, leave a more regular and better stope back than can be obtained with vertical holes drilled by a telescopic stoper. The latter machine, however, has its place in suitable orebodies, especially where the whole stope can be drilled and blasted before scraping the ore to the chute.

The world-wide popularity of the jackhammer-airleg combination which has come with improvements in valve control of the telescopic feed has extended to Australia. In most mining districts this equipment, particularly but not necessarily in conjunction with tungsten-carbide bits, is proving its value in narrow lodes and square-set stoping. A number of mines are using it entirely. To date, however, opinions on its use in wide cut-and-fill stopes without timber are varied and could depend mostly on whether one or two men per machine is the rule.

Similar remarks apply to shrinkage stoping.

For rill stoping, the column-mounted drifter has been superseded by lighter types of machines. The present trend is towards use of jackhammer-airleg combinations.

Drill Bits and Rods

Diamond Drilling—A common practice in long-hole drilling is to use coring bits for some distance, 20 ft. or so, depending on circumstances, and non-coring bits thereafter. Factory-made bits and reamers, cast-set or sinter-set, are universally used.

Percussion Drilling—Use of conventional steel, forged in mine shops, was standard practice in most mines until the end of World War II, although practically every large mine in the country had, over a number of years, made small- and large-scale tests on many brands of multi-use carbon-steel detachable bits from overseas sources. All of them drilled at least as well as properly prepared conventional steel bits produced under good mine-shop conditions. It was common experience, however, that the attachment—drill rod to bit—was defective, particularly when they were used with hard-hitting 3½-in. drifters.

Following the war, one-pass bits were introduced into Australia by several manufacturers, English, South African and American. These proved attractive and were competitive or nearly so with mine-forged conventional bits, and it appeared that any additional expense could be more than made up for in decreased distribution costs, particularly in widespread workings. A number of mines are now using these bits, several of them made in Australia. There are two variations of attachment to the drill rod—parallel and tapered rod ends and bit skirts. Both types of rod end can be satisfactorily forged in a pneumatic drill sharpener or forging hammer using suitable dies.

Carbide inserts in steel bits were pioneered in Europe and considerable development took place during World War II. This was continued in many countries afterwards. The defects of attachment of detachable forms of this bit have militated against their general use and the application of tungsten carbide-inserts to alloy steel rods is now the more common.

Hard ground, that presents difficulties due to loss of bit sharpness and gage when drilling with conventional steel or one-pass bits, can be more efficiently drilled with tungsten-carbide bits or inserts in alloy-steel rods. These forms of boring tools may eventually replace all others in mines where short blast-hole drilling is practiced. Also, in connection with sublevel stoping, there is application for detachable carbide bits and jointed rods for long-hole drilling.

In horizontal cut-and-fill stoping at Broken Hill, holes are bored with drifters using steel up to 17 ft. long with either one-pass bits or tungsten-carbide inserts.

The practice in regard to drill-rod shanks varies throughout the mining districts. The sections and shanks of plain carbon-steel drill rods in general use are as follows:

- 1¼-in. round, lugged shanks.
- 1⅛-in. round, lugged shanks.
- 1-in. quarter-octagon, plain shanks.
- 1-in. hexagon, collared shanks.
- 1-in. hexagon, plain shanks.
- ⅞-in. hexagon, collared shanks.
- ⅞-in. hexagon, plain shanks.

Tungsten-carbide-tipped, alloy-steel rods are used in 1-in. and ⅞-in. hexagon section and mainly with collared shanks.

Rotation of the drill rod by the machine chuck requires that round steels have driving lugs forged on them, but the selection of the shank for other sections is one of individual preference. Many operators think that the loss in drilling efficiency occasioned by introducing a tappet or anvil block between the rock-drill piston and the drill rod is more than countered by the cost of forging shanks and the lost time when a shank breaks off. Another factor is the accident risk to the miner boring down holes with a jackhammer; a broken shank may result in serious abdominal injury.

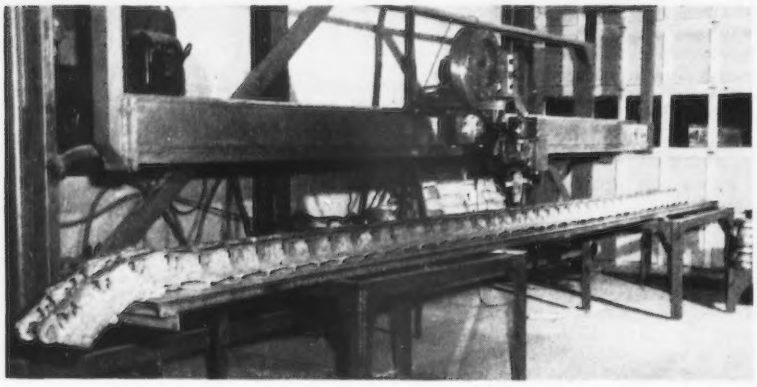
However, it has been found that forged shanks on tungsten carbide-tipped drill rods, made under better control than is normally possible in mine drill shops, in general last until the carbide inserts are worn out.

Sinking With Remote-Controlled Clamshell

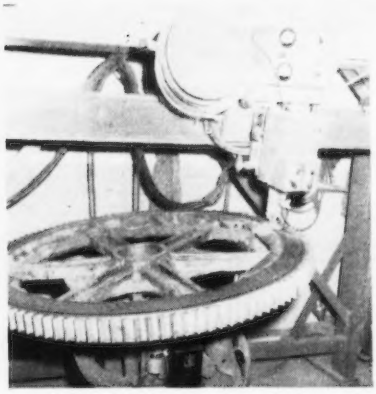
A 1600-FT. SHAFT and two 850-ft. shafts are being sunk by Cowin & Co., of Birmingham, Ala., with the sinking method developed by the company which uses remote-controlled clamshell for mucking operated by a man in the shaft bottom. In employing this method two Ingersoll-Rand 4K-UL tugger hoists are installed at the shaft collar. With these the man in the bottom lowers, closes, and raises the clamshell. As he lifts the loaded clamshell, two men, using ropes attached to either end, swing it into position over the shaft bucket. The operator then releases the load and the clamshell is swung back into position for another load. Another man keeps the walls scaled as they are uncovered. The shaft bucket, when filled, is raised to surface where it is hooked from the side by a stationary cable and lowered out of the shaft area. It is emptied into a dump truck by the driver and a top man. The operator of the main hoist and the foreman complete the crew.

On occasion, to save rope, the tuggers are lowered into the shaft. A 1700 ft. shaft was completed in June in which this was done when the shaft has reached 1300 ft. depth. The tuggers were lowered 1100 ft. and anchored for the rest of the job.

KEEPING TAB ON PRACTICE (*Continued*)



USE OF AUTOMATIC FIXTURE of special design speeds resurfacing of crawler track.



SHOVEL BULL GEAR is being salvaged at one third cost of a new one.

Hardsurfacing Fixture Speeds Repairs

CRAWLER TRACKS can be rebuilt four times faster than with manual methods by using the specially designed flexible hardsurfacing fixture shown. This was developed for a large mining company by I. R. Bartter, Elm Grove, Wisc., who has organized the Automatic Welding Co., according to J. S. McKeighan, Lincoln Electric's district engineer. A crawler track is shown in position so that a 5/17-in. build-up may be deposited on the rails.

With overall length of 22 ft. the beam has an overhang of 3 ft. and can be raised 5 ft. above the table through a motorized hoist. A standard head of the hidden-arc type travels on the beam. By incorporating a special type of multiple roller or idler fixture, the same head can handle several operations.

The same crawler track can be hung on an idler pulley for easy rotation to permit relugging. Grip lugs are first tacked in place and then completely welded from both sides with a portable semi-automatic welder and low-hydrogen electrodes. The job takes half the time required manually.

The turntable shovel bull gear, also illustrated, was rebuilt with the setup as shown, using L-201 (Lincoln) medium-carbon electrode wire and an automatic hidden-arc head. Teeth were brought to final size with a shielded-arc electrode for dense, tough medium-carbon deposits. Salvaging the gear cost less than $500. A new one would have cost over $1400.

LETTERS TO THE EDITOR (*Continued from page 4*)

national Union of Pure and Applied Chemistry in September 1949, that the name niobium, symbol Nb, should be adopted. Despite protests by the chemists of the U. S. Geological Survey, who prefer columbium, this decision was accepted by the American Chemical Society and was reaffirmed by them in 1950, since when niobium has been used in all their publications. The Government Printing Office now specifies use of the term niobium rather than columbium.

I presume that you will be somewhat gratified by the fact that the American Chemical Society did not follow the recommendation of the Survey chemists and refused to accept the name wolfram for tungsten. The latter is still preferred in the United States.

W. E. WRATHER

Director Geological Survey

Pro Columbium

SIR:

Apparently nobody bothered to invite authors and publishers of American textbooks to the meeting of the International Union of Pure and Applied Chemistry in September, 1949. Certainly no one seems to have taken the trouble to inform them of the columbium-niobium decision. Through this oversight, thousands of students every year continue to be misled by studying from textbooks which do not mention niobium at all, or merely indicate that it is a term sometimes used in place of columbium.

This could set standardization back 20 years. Nor does it seem to aid the advance of standardization to have a USGS release state, "Niobium, better known as columbium . . .," and then proceed to use columbium consistently throughout the release.

I yield to no man in my eagerness to standardize scientific terms, but the essence of standardization is consistency.

E pluribus columbium!

GEORGE P. LUTJEN

Mine Law Changes

SIR:

Compared to current topics in *E&MJ*, the subject of mining titles is about as stale as virtue. Nevertheless, the crusade now on to place mining rights under a leasing system may gain momentum unless something is done.

A few simple amendments to the present mining regulations can bring the laws up to date, and correct practically all of the abuses to which the present laws are subject. A new system of laws is not required—only a few amendments to those existing.

American mining law is now about half the age of the Constitution, and during its existence it has met the requirements of mining in a superior American Way. Mining regulations can be easily revised without disturbing (those) which should be retained.

NEWTON L. HALL

Long Beach, Calif.

More On July

SIR:

In your July issue, page 224, we found a reference to our company which is not quite accurate. Just for the sake of exactness we would like to correct the impression (that) our mine at Puerto Cristal (is) a zinc mine. In lieu of the figures you mention we offer the following: production started in 1951; today we export 500 tons, high grade lead concentrates, 200 tons high grade lead ores and 300 zinc concentrates per month.

We point out . . . the mine is mainly a producer of lead, to convey the right idea about our company (and) one of the southernmost mines on earth.

F. Z.

Compania Minera Aysen
Santiago, Chile.

They Do Things in a BIG Way on the Iron Range!

Two No. 8 Dorrco Type W Pumps installed on the iron range. Pumps handle coarse, deslimed hydroseparator underflow and "meter" it for further treatment.

And the Pumps they use are no exception. For example, these two Dorrco Type W's are pumping hydroseparator underflow containing 40% solids at a rate of 135 long tons per hour! What's more, the Type W's double as "meters" ahead of further beneficiation equipment. A stroke adjustment handwheel, with calibrated indicator, provides close control over the entire operation.

For your really big pumping jobs, check these advantages of the Dorrco Type W Pump —

Big capacity — A 6" duplex (#6) will pump up to 30 cubic feet per minute while an 8" handles up to 75 cubic feet.

Stroke adjustment while running — Discharge rate can be varied within a 6 to 1 range *while pump is in operation*. An easy turn of the stroke adjustment handwheel does it.

Many mechanical advantages — Cranks and ball bearings replace power consuming eccentrics and low efficiency sleeve bearings. Lubrication is simplified by Oilite bushings and anti-friction, grease lubricated bearings throughout.

This is the information to have . . . Bulletin No. 5002 describes the Type W Pump in detail. For your copy, just drop a line to The Dorr Company, Barry Place, Stamford, Conn.

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WASHINGTON IMPACT

Morton A. Reichek, McGraw-Hill Washington News Bureau

Washington Puts Lid on Mobilization Plan
Mining Faces Tighter Expansion Policy

WASHINGTON IS PUTTING the lid on the mobilization program. Some sort of slowdown was anticipated, of course, with the close of the three-year, post-Korea defense build-up. But the new policy has more significance. It's a virtual abandonment of the "broad base" concept of mobilization planning. That involves maintenance of an industrial mobilization base in peacetime keyed up for quick conversion to war needs.

To mining, the new trend will mean: (1) An even tighter policy on Government-stimulated metals and minerals expansion than had been expected; (2) A slowdown on stockpile acquisitions; (3) A cutback in the exploration program and (4) Removal of a defense prop to many metal-working industries, which should reduce projected demand for metals.

During the past year, it already was becoming apparent that mobilization was petering out. But there had been a feeling that the new administration, once it got its feet on the ground, would revitalize the program. The ODM reorganization was interpreted by informed observers as a positive step in this direction.

Deemphasis on mobilization—or "demobilization," as critics in and out of Government refer to it—is now increasing, however, heightened by the Korean truce. Last month, this column reported that the administration's new economy campaign would put a damper on mining expansion. The details have since become evident.

Expansion Goals and Incentives

For one thing, ODM is scaling down the expansion goals on which accelerated tax amortization is based. ODM plans to kill about 150 of the 235 goals, including many far from completion. At least 40 are less than 75% under way. This may mean a virtual suspension of the fast tax writeoff program.

The new policy won't really affect primary metals industries directly. Tax amortization certificates haven't been an important expansion incentive for a long time. Titanium and nickel have been exceptions and will continue to rate rapid tax writeoffs. But the tighter rules will slow down expansion in some metalworking industries, it was agreed.

Along with tighter amortization regulations, ODM is shelving its ambitious study to measure production potential under full mobilization. It was started under the previous administration. Its objective: To match up projected production and construction levels for various military defense-supporting, and essential civilian programs with existing raw material, fabricating, and assembly-plant facilities—then show up specific capacity gaps.

This would have meant additional or increased expansion goals for many industries, including mining. With what's left of the expansion program now, only titanium, nickel, cobalt, and mica producers can look for any more DMPA-type procurement contracts, at least unless international developments dictate a change in policy.

Stockpile Slowdown

Second step in ODM's new policy is a stockpile slowdown. This is directed by the administration's drive to cut Government spending. Its effect: New purchase commitments will be limited to the approximately 10 most critical materials on the stockpile list. Of the 75 on the list, objectives for 35 have already been achieved—by actual delivery or contracts for future shipment. An additional 15 are listed as 80% or more complete, 25 less than 80%.

The slowdown policy will not disturb existing stockpile contracts. Nor will it affect outstanding DMPA agreements or the small-lot domestic purchase program. Pending Bolivian tin and Chilean copper deals will be exempted too. But the new policy will restrict new purchases to one year plus lead time on deliveries, except for very special cases.

The stockpile slowdown has already been criticized within the Government. Some high officials objected to the stockpile's entry into the market when metals were tight—competing with industrial consumers and pushing prices up; now they decry the stockpile's virtual withdrawal from an already declining market.

According to the American Mining Congress, no new stockpile commitments will be made for cobalt, metallurgical chrome, nickel, manganese, copper, fluorspar, tungsten, tin, lead and zinc.

Officially, specific stockpile objectives and amounts on hand are secret information. The stockpilers say they want to prevent unfair market advantages for prospective stockpile sellers. This policy made sense several years ago, when few stockpile contracts had been negotiated and the bulk of purchasing was still to be made. Now, however, with 79% of total objectives achieved, the secrecy policy is incongruous. If anything, it creates unhealthy speculation on what the stockpile will buy and has an adverse market effect.

More basically, it looks silly for the Government to cloak what's left of stockpiling in secrecy, while disclosing substantial information on armaments production, troop movements, and other vital military data. In addition, most stockpile materials are now bought from foreign suppliers, who can be assumed to know the score. But declassification of stockpile information isn't even being considered at this time.

DMEA Program Cutback

At press time, ODM was planning to curtail much of the Defense Mineral Exploration Program, eliminating certain minerals and reducing percentages of Government participation. Although DMEA is an Interior Department agency, it takes orders from ODM, is financed with Defense Production Act funds. This will be the program's second big cutback. The last one was in May, when 20 minerals were deleted from DMEA's shrinking list.

In addition to the anticipated cutbacks, DMEA has other problems. Until recently, the agency received an annual allocation of DPA funds and was able to obtain supplemental funds when necessary. Under new ODM policy, the agency now receives quarterly allocations instead, and its supplementary fund privileges will be tightened up. This hand-to-mouth type of operation will hinder DMEA's planning considerably.

DMEA has signed 554 exploration contracts, valued at $27-million, out of 1,968 applications. Discovery certificates have been issued to 58 projects, and 140 others have showings of ore and should be ultimately certified, too. About 22 projects have shipped ore, and over 50 already have paid royalties.

DMEA's authority is good until July, 1955, but it's uncertain whether the program will be continued that long. During the last four months, applications have averaged 33 monthly. During the last 17 months, the average was 44—with a high of 57 in March, 1952, and a low of 30 in January, 1953. Approvals still run at about 25% of applications.

Since a recent clarification in the mining laws, which validates title to mining locations on lands held under oil and gas leases, DMEA expects a surge of uranium exploration. Formerly, no mining claims were recognized on these lands.

(Continued on page 106)

JENKINS PRACTICAL PIPING LAYOUTS

65

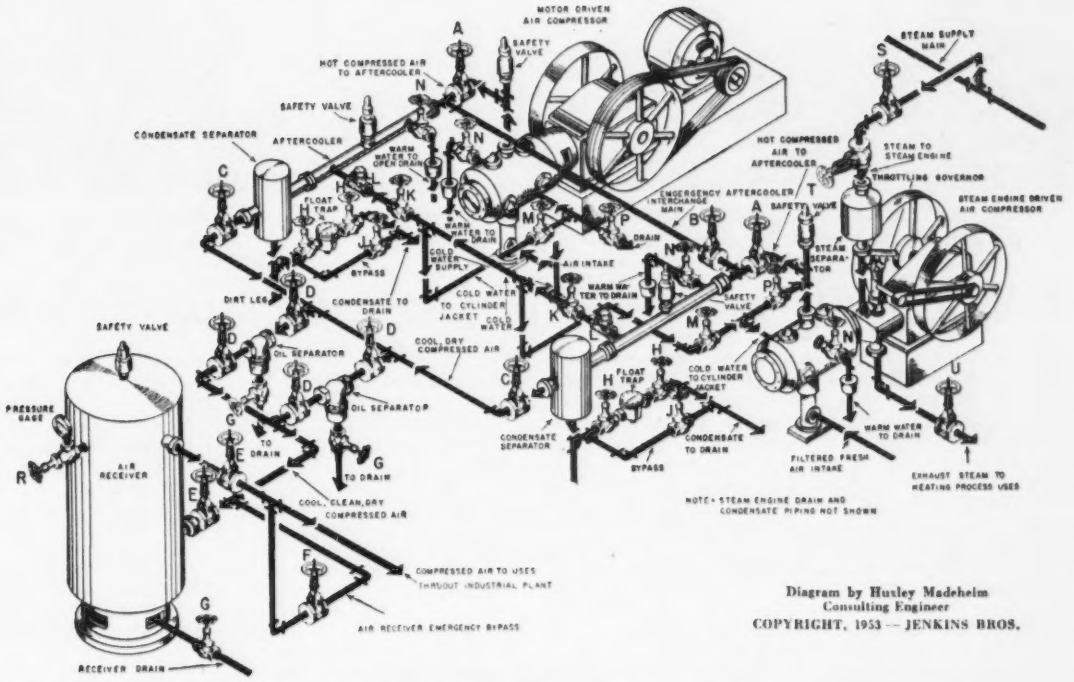

Diagram by Huxley Madeheim
Consulting Engineer
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VALVE RECOMMENDATIONS
Send for details of Jenkins Valves to suit varying conditions.

Code	Quan.	Jenkins Valves	Service
A	2	Fig. 651-A I.B.B.M. Gate	Compression Discharge Shutoff
B	1	Fig. 651-A I.B.B.M. Gate	Emergency Changeover Line
C	2	Fig. 651-A I.B.B.M. Gate	After Cooler Shutoff
D	4	Fig. 651-A I.B.B.M. Gate	Oil Separator Shutoff
E	2	Fig. 651-A I.B.B.M. Gate	Air Receiver Shutoff
F	1	Fig. 651-A I.B.B.M. Gate	Air Receiver Shutoff
G	3	Fig. 106-A Bronze Globe	Drain Line
H	4	Fig. 950 Bronze Globe	Trap Shutoff
J	2	Fig. 950 Bronze Globe	Trap By Pass
K	2	Fig. 106-A Bronze Globe	Cold Water Control
L	2	Fig. 352 Swing Check	Prevent Backflow
M	2	Fig. 106-A Bronze Globe	Cold Water Control
N	4	Fig. 106-A Bronze Globe	Drain Shutoff
P	2	Fig. 106-A Bronze Globe	Drain Shutoff
R	1	Fig. 744-G Needle Angle	Pressure Gage Control
S	1	Fig. 204 I.B.B.M. Gate	Steam Supply Line
T	1	Fig. 923 I.B.B.M. Globe	Steam Engine Shutoff
U	1	Fig. 651-A I.B.B.M. Gate	Engine Exhaust Shutoff

How to plan PIPING CONNECTIONS FOR AN INDUSTRIAL PLANT AIR COMPRESSOR

Compressed air is more economically supplied from a central installation in plants where demand is extensive. In such a system, the highest single pressure requirement in the plant determines the number of compression stages needed, and local pressure reducing stations meet the requirements of specific operations.

A single stage system is shown in this layout. Equipped with electric and steam driven compressors, this installation can develop 125 p.s.i. The former usually serves as a stand-by unit, but both can be used jointly for heavy load conditions.

The compressed air, after leaving the compressors, passes through a water-cooled after-cooler, which lowers air temperature and condenses moisture. The air then goes through oil separators and on into the air receiver, which decreases pressure pulsations and serves as a storage reservoir.

A capacity reduction device helps control load fluctuations in the constant-speed electrically driven compressor. In variable speed steam driven compressors, the throttling governor responds to load changes.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of lowest cost in the long run. Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 65.

JENKINS VALVES
LOOK FOR THE DIAMOND MARK
SINCE 1864

Jenkins Bros

AT SPEAKERS TABLE (l. to r.) Travis; Mrs. Mildred Smothermom and Mrs. Dorothy McDonald, MM&S Ladies Auxiliary; Joe Johnson, speaker, sec.-treas., National Union of Marine Cooks & Stewards; Clark, Larson and Wilson.

Labor Unity is Theme of Mine-Mill Convention

LABOR UNITY was the theme of the 49th convention of Mine, Mill and Smelter in St. Louis. The convention noted that the promise of labor unity is at its highest peak since the AFL-CIO split, and at a time when the labor movement is "under the most serious attack" since the New Deal began.

Significantly, Mine-Mill made a plea for bargaining cooperation "among all the unions" in the nonferrous mining industry as a first step toward unification of all labor organizations in all industries. To this end, the convention recommended that members in locals that have lost bargaining rights "lay aside any feelings of bitterness against raiders" and join up with the union that has taken over. Locals at Tennessee Coal & Iron in Alabama and some "lead belt" locals were cited as examples.

Mine-Mill would like to see unions having contracts with the same company in copper, brass, lead-zinc and iron ore industries bargaining jointly through national councils. This is what the CIO automobile workers and AFL machinists are trying to do in the aircraft industry and CIO and AFL unions have tried in meatpacking.

(Observers saw little chance that Mine-Mill's chief rivals—the CIO Steel Workers and AFL Metal Trades Unions—would make any deals for cooperating with Mine-Mill. The CIO, in fact, hopes to step up its drive to displace Mine-Mill, which it expelled several years ago as Communist dominated.)

There was no sign of any serious break in the strongly Communist-minded top leadership in nominations for officers, who will be elected in a referendum later.

Secretary-Treasurer Maurice E. Travis, admitted former Communist who hasn't changed his views, has only token opposition from Charles McLean of Anaconda, Mont., and Castulo Sanchez of Douglas, Arizona.

Charles Wilson stepped down as eastern vice president and nominated Asbury Howard, regional director at Bessemer, Ala., as his successor. The Communist New York Daily Worker, which played up the Mine-Mill convention with big front-page headlines, said "many of the delegates were visibly impressed to see a white leader in high position step down and deliver a vigorous speech in support of a Negro for the office." The Daily Worker picked Howard as a strong favorite to defeat another nominee, Ernest Gunsalus of Buffalo.

The other two top officers—President John Clark and Western Vice President Orville Larson—have no opposition.

Travis reported a $41,000, or 15%, increase in assets, from $268,100 to $309,600, during the fiscal year ending last June 30. He warned, however, that a "downward trend" in the union's financial situation after June 30 had forced the union to borrow $23,000 for the first time from its contingency fund to meet payroll and operating expenses. He blamed this largely to the "bargaining fight" which he said was "complicated by the most difficult circumstances in many years."

The convention also:

- Reported that contract gains "valued at over 9¢ an hour in cash and benefits" compare favorably with wage gains of other unions.
- Heard James Byrne, member of parliament from British Columbia and former president of a mine-mill local at Kimberley, B. C., urge "freer trade" between the United States and Canada rather than restrictions like the sliding scale tariff on lead and zinc contained in the Simpson Bill.
- Announced the controversial movie, "Salt of the Earth," will be ready for release before December. Mine-Mill is co-producer.
- Attacked the Butler Bill to control communism in unions as destroying the American labor movement.
- Criticized the Republican administration and called for repeal of the Taft-Hartley act.
- Applauded New Deal measures and supported re-election of Sen. James D. Murray of Montana and Sen. Clinton Anderson of New Mexico, both Democrats.
- Hailed Adlai Stevenson's statement—"door to conference room is door to peace"—adding, "We welcome Mr. Stevenson's advocacy of conferences with the Soviet Union leading to world disarmament."
- Called for abandonment of "cold war policies" and turning the nation's energies to "production for peace."

Tariff Prospects Brighter

PROSPECTS FOR increased tariffs on lead and zinc have brightened. One big booster has been the Tariff Commission's acceptance of the National Lead and Zinc Committee's "escape-clause" relief application. Next month, the Commission will hold hearings on the application concurrently with an investigation ordered by Congress. This will be the Commission's first mining escape-clause relief investigation and the first Congressional-directed metals tariff probe since the 1932 copper study.

Under the latter probe, the Commission will report to the Senate Finance Committee and the House Ways and Means Committee on the effect of lead and zinc imports on domestic producers. There will be no official recommendation. The report, due March 31, 1954, will provide background for appropriate legislation, such as a new sliding-scale tariff bill now being drafted. Escape-clause relief wasn't sought earlier because the sliding-scale bill, bottled up this year, was considered more politic.

Caterpillar power keeps it swinging

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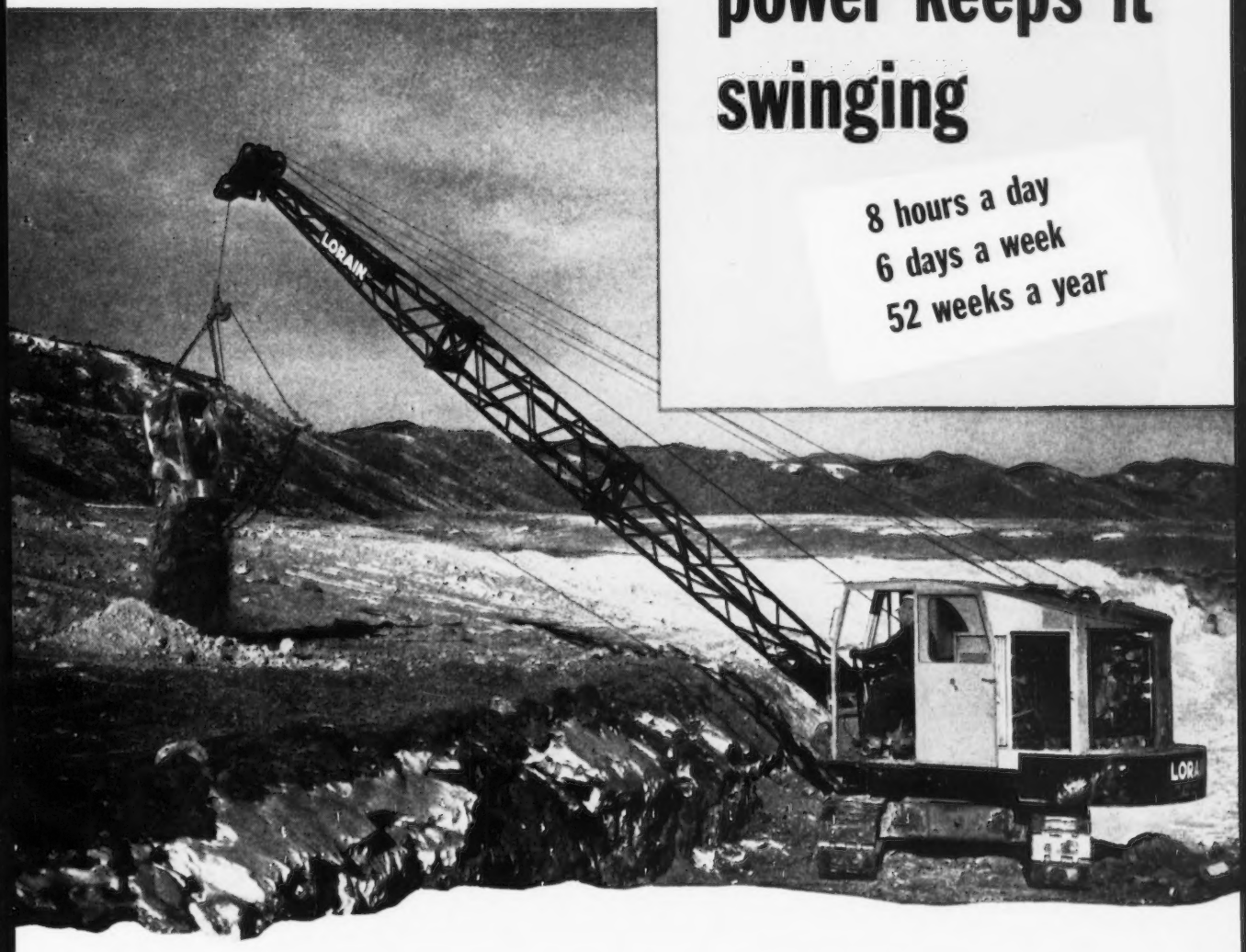
6 days a week
52 weeks a year



THIS clay-stripping operation is more than a mile high in the Rockies, near Denver. In winter there is frozen ground and engine-testing cold. In summer, fine abrasive dust tests the effectiveness of engine filters and seals. Yet this Caterpillar-powered ¾-yd. Lorain dragline maintains a steady swing, three buckets a minute, eight hours a day, six days a week, around the calendar.

The rig is owned by George W. Parfet Estate of Golden, Colo., which produces clay used in fine ceramics, pottery and tile. This firm also has a Caterpillar D6 Tractor. "Our Cat* equipment has done very good work for us," states Vice President William G. Parfet.

It's a tough job—and the Caterpillar D315 is up to it. Quick-starting, even in sub-zero weather, it has stamina and power to work in frozen materials. It delivers full horsepower, and idles without fouling, on low-cost No. 2 furnace oil.

Many mining operators have winterized their jobs with dependable, pamper-free Caterpillar power. There are 12 sizes of engines and electric sets, to 500 HP and 315 KW. Leading manufacturers can supply Cat Engines in their mining equipment. And you can get replacement power from your Caterpillar Dealer. Ask him for proof of performance today. And see him for fast service and genuine factory parts.

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That was the one-year record made on the 42 mile long Union Pacific Line Change, between Cheyenne and Dale Creek, Wyoming. To complete the job, largest since driving the famed golden spike joining East to West in 1869, took a combination of skill and teamwork by the Morrison-Knudsen Company . . . plus good equipment. And that's why Crucible Hollow Drill Rods were used.

Made to tool steel standards by the world's largest producer of special purpose steels, Crucible Hollow Drill Rods' *extra* quality means minimum rod breakage and fewer losses of valuable bits. You can be sure of long, uniformly dependable service, lot after lot, when you buy Crucible Hollow Drill Rods.

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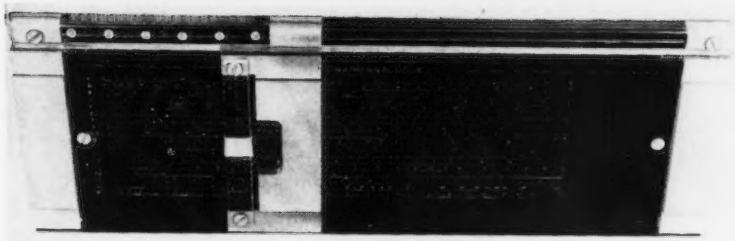
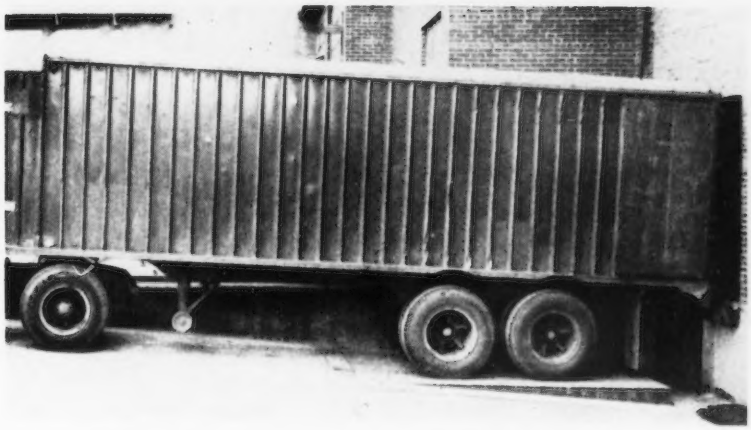
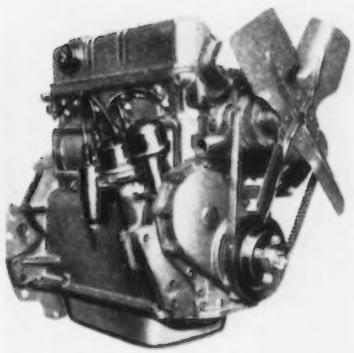


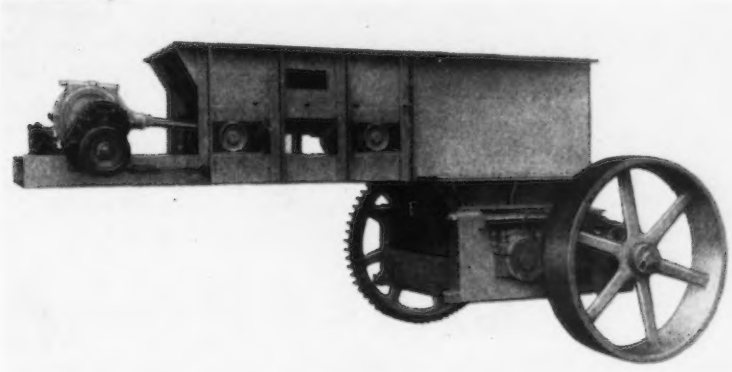
GRAPHANALOGUE has 18 scales including logarithmic, probability, trigonometric, power, linear, and reciprocal. Multiplies graphs or curves directly. Divides any distance into logarithmic or any arbitrary nonlinear proportions. Instrument is 11 in. long. Gerber Scientific Instrument Co., Hartford, Conn. (1)



"ADJUST-A-TRUCK" raises or lowers trucks to the level of the loading platform by means of heavy-duty electric hydraulic system. Capacity of 10 x 12-ft. or 9 x 12-ft. deck is 20 tons. Raising, lowering are instantaneous. Rowe Methods, Inc., Cleveland. (2)



GASOLINE ENGINE available from Ford Motor Co., Dearborn, Mich., is a 4-cylinder overhead valve model developing 45 hp. at 2400 rpm. Designated as "Ford 134," it has 3.4375-in. bore, 3.6-in. stroke. (3)



RECIPROCATING PLATE FEEDER Model HDF, has capacity up to 500 tph. Handles materials from sand up to largest shovel feed. Rate is easily adjusted. Variety of drives is available with electric motor. McLanahan & Stone Corp., Holidaysburg, Pa. (4)

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. . . facing p 110 will bring you more details on any item in this section without obligation. Just circle the numbers, sign card and mail.

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If you own Cat* equipment you know it will do these things. If you're using another make, here's your chance to find out whether or not you're getting your money's worth.

If you've never used Caterpillar equipment on your job our dare gives you a chance to compare the working ability of Cat machines with others.

Take the dare . . . get a demonstration . . . any way you look at it, you'll be the winner.

Call your Caterpillar Dealer and say, "Yes, I'll take your dare." Tell him where and when. He'll do the rest.

Caterpillar Tractor Co., Peoria, Illinois.

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NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

Equipment Shorts

HEAVY-DUTY AIR HOSE. B. F. Goodrich Co., Akron, Ohio, announces a new heavy-duty air hose suitable for working pressures up to 400 lb. per sq. in. Called "Commander," the hose is reinforced with a single braid of high-tensile steel wire and is said to be more flexible than other types of heavy-duty air hose. Manufactured in ½, ¾ and 1-in. sizes, the hose is designed for rugged service in mines, quarries, construction projects, and for general industrial use where high working pressures are required or where the hose cover is subjected to severe abrasion. An oil-resistant hose tube permits tool to be oiled through the hose, and a light gray oil-resistant cover increases visibility of the hose for mining use. (31)

WATERPROOF MINE COATING. A new mine roof (or ceiling) coating, Das-Seal, that penetrates rock strata and forms a protective seal against moisture has been placed on the market by the Dasco Chemical Co., Baltimore, Md. Non-toxic and non-inflammable, the compound can be sprayed with any type of spray equipment or can be painted over rocks. Das-Seal help prevent the danger of falling shale, which has been shown to be caused often by moisture penetration through roof and ceiling due to condensation in the mine. The compound is inexpensive, as a small portion spreads over a large area. (32)

CONVEYOR BELT. A new conveyor belt designed to carry hot materials has been patented by the B. F. Goodrich Co., Akron, Ohio. A nylon cord breaker imbedded in the thick rubber cover of the belt resists heat damage and extends the service life of the cover. The nylon cord reinforcement resists formation of transverse cover cracks caused by heat, prevents the penetration of such cracks to the carcass, and stretches with the rubber cover when the belt is flexed as it moves around a pulley. (33)

CHAIN. A new combination chain for bucket elevators and conveyors which has from 450 to 600% more metal on the wearing tread of each link is announced by Beaumont Birch Co., Philadelphia, Pa. The added metal not only results in more efficient operation but increases the service life of the chain. Block links cast of either malleable iron or Beauco-CR metal, are used, depending on the application. Side bars are of high-carbon steel. Connecting pins of forged steel are used on the malleable iron chain, and heat-treated steel pins are supplied with the Beauco-CR chain. (34)

FAULT-FINDER. Joy Mfg. Co., Pittsburgh, Pa., reports the availability of a light-weight (23-lb.) cable fault finder for locating open-circuits or low and high resistance shorts of 10,000 ohms or less, for rubber, neoprene, thermo plastic or similar jacketed cables. Manufacturer states that this new unit is ruggedly constructed and extremely simple to operate. Both the self-contained transmitter and receiver (separate units) are powered by standard, easy-to-replace dry cells. Space is provided in the transmitter's carrying case for the receiver so that complete fault finder can be easily carried as a unit. (35)

SILICONE RUBBER COATING. General Electric Co.'s SE-100 silicone rubber compound used on the company's G E 76510 glass cloth tapes and wrappers tailors the insulation on coils, motor leads, power cables and transformers with outstanding electrical and physical strength as well as superior heat resistance. GE's laminated and insulating products department, Pittsfield, Mass., announces that the new coating has replaced the ordinary silicone material formerly used on this standard Class H insulation. G E 76510 insulation with the new coating has excellent abrasion resistance and a tensile strength of 130 lb. per in. of width. Its water absorption of only .85% after 96 hours of immersion makes it particularly applicable where moisture is a problem. Available in widths up to 36 in. and in a thickness range from 7 to 17 mils. (36)

SILICONE RESIN. A single silicone resin can now be used for a variety of insulating applications which ordinarily require several different materials. The new insulating varnish, SR-17, developed by General Electric Co.'s silicone products department, Waterford, N. Y., possesses an unusual combination of heat resistance, low temperature flexibility and high bonding strength. Multiple uses for the product include coating glass cloth for power cable and Class H insulation, providing a tough bond for flexible mica tapes and coil wrappers, treating glass sleeving, impregnating asbestos for layer insulation, and forming a resin base for paints requiring heat and weather resistance. Use card below to obtain more information. (37)

OIL AND GREASE RESISTANT FLOORING. An improved oil and grease resistant flooring, has been announced by United Laboratories, Inc., Cleveland, Ohio. Known as Sylox, the product is a type of oxychloride cement that is highly resistant to absorption of oil, grease, fats and solvents of many kinds. Sylox is a complete flooring "unit" in itself and no outside ingredients need be added, not even water. Each "unit" is proportioned and packaged at the factory and is designed to cover a predetermined area at an average depth of only ½ in. The product may be applied directly over old surfaces of concrete or wood and is available in a choice of several colors. (38)

USE THIS CONVENIENT CARD

to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, tear out and mail.

Not good after December 1, 1953, if mailed in the U.S. or Canada.

Engineering and Mining Journal—October, 1953
NOT GOOD AFTER DECEMBER 1, 1953—if mailed in U. S. or Canada

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	8	15	22	29	36	43	50	57	64	71	78	85	92
2	9	16	23	30	37	44	51	58	65	72	79	86	93
3	10	17	24	31	38	45	52	59	66	73	80	87	94
4	11	18	25	32	39	46	53	60	67	74	81	88	95
5	12	19	26	33	40	47	54	61	68	75	82	89	96
6	13	20	27	34	41	48	55	62	69	76	83	90	97
7	14	21	28	35	42	49	56	63	70	77	84	91	98

My Name ..... Position .....

Company .....

Address .....

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

PACKAGED BOILERS. Bulletin 1219 describes Powermaster packaged automatic boilers in seventeen sizes from 15 through 500 hp. for steam process as well as steam and hot water heating service. Detailed specifications describe the boiler, burner, and control systems. Typical installation photographs are reproduced emphasizing fuel savings, automatic operation, various firing arrangements and simplified maintenance. Drawings, cutaway views, and useful boiler data all make this new publication a valuable reference. Orr & Sembower, Inc., Reading, Pa. (51)

FRICTION CLUTCHES. An illustrated engineering data sheet (Form S31-53) describing the new line of Morse torque-limiting slip type friction clutches, which provide overload protection for a variety of machine drives by functioning as an automatic shear pin mechanism, is now available from Morse Chain Co., Detroit, Mich.

The data sheet, which is punched for a 3-ring binder, includes dimensions and capacities of standard 4½, 5½ and 6½-in. dia. adjustable clutches. Tables of specifications of standard Morse Type A plain plate roller chain sprockets that can be used in connection with the compact torque-limiting clutches are also included. (52)

HARDFACING. Alloy Rods Co., York, Pa., has issued a 12-page catalog in color on its lines of Wear-Arc hard-facing electrodes and Wear-Flame hard-facing rods, offered in nine and four basic types, respectively. Catalog is written from the "how to do it" standpoint, and three pages are devoted to an "Application Guide" citing wear parts, types of wear, and the correct electrode or rod to use in 13 major industrial applications, on about 75 common types of hard-facing problems. (53)

PUMPS. Bulletin W-300-B4 covering its line of SESC (standard end suction centrifugal) Pumps is now being offered by Worthington Corp., Harrison, N. J. The line covers six types of pumps with varieties of mountings, frames, and drives. (54)

DIESEL ENGINES. A 48-page booklet offered by Murphy Diesel Co., Milwaukee, Wisc., gives detailed descriptions of engineering design features to look for in diesel engines. In addition, ratings and descriptions of Murphy Diesel models are presented. Nineteen pages of photographs of typical installations are shown. (55)

TRACTORS. Presentation of four Diesel-powered Allis-Chalmers Mfg. Co. crawler tractors "Inside and Out" is made in a unique way with this catalog which shows details of construction of each model with full cutaway pictures, and the variety of applications of each on the job. As the pages are turned, a spread of the cross-sectional views with the job application illustrations found for each model. When completely opened, the four tractors in cross section are on view. (56)

POWER TOOLS. Syntron Co., Homer City, Pa. has just released Catalog No. 537, illustrating and describing its complete line of Portable Power Tools. It includes information and specifications on electromagnetic hammers and hammer drills, the complete line of portable electric drills, screwdrivers, nut runners, polishers, sanders, and grinders. Information is also included on the electric impact wrench recently made available. (57)

FORK LIFT TRUCKS. A "driver's eye view" of the operation, construction and servicing features of the Buda FT Series fork lift trucks plus a complete presentation of the entire materials handling line is offered by Buda Co., Harvey, Ill., in a 36-page Fort Lift Truck Fact Book. (58)

VACUUM FURNACES. "Vacuum Furnaces and Their Application to the High-Vacuum Processing of Metals," four-page Catalog No. 770 discusses in some detail a number of processes carried out in the three types of vacuum furnaces now being built. F. J. Stokes Machine Co., Philadelphia, Pa. (59)

PUMP MOTORS. Louis Allis Co., Milwaukee, Wisc. has released Bulletin No. 1250 covering its line of hollow and solid shaft vertical pump motors. The bulletin shows types of enclosures available for these units and illustrates varied uses for these motors. Four-color cutaway illustrations and phantom drawings show details of the non-reverse ratchet types of oil and grease-lubricated thrust-bearings available, and specific features of motor construction. (60)

FIRE PUMPS. Ingersoll-Rand Co. has made available a 4-page descriptive bulletin, Form 7226, on its line of horizontal, single-stage and vertical, multi-stage fire pumps. Cross-section of the design, construction and performance of these pumps are contained in the bulletin. (61)

HIGH-VACUUM PUMPS. A revised edition of the 36-page catalog, "Stokes Microvac Pumps for High Vacuum," has been, issued by F. J. Stokes Machine Co., Philadelphia, Pa. The new catalog, No. 750, includes valuable tables of formulas, constants, and conversions frequently used in vacuum

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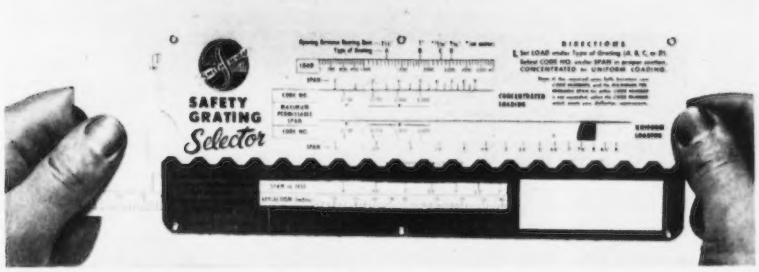
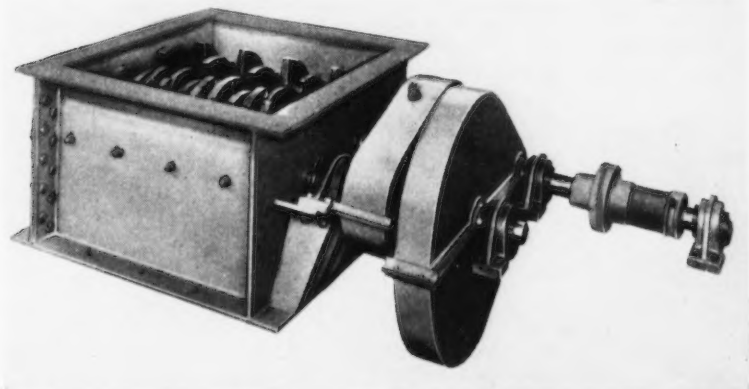
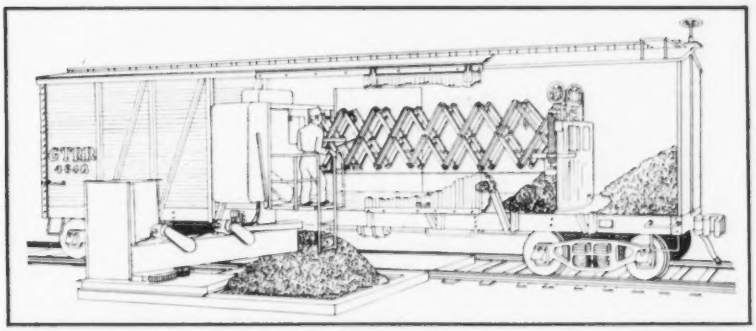


GRATING SELECTOR automatically gives correct steel grating size for any specific load-span condition of the floor. Selector also gives reflection and has table of stock sizes and weights. Works like slide rule. A. O. Smith Corp., Milwaukee.



CLAY CRUSHER has one roll turning at 35 rpm. to feed and cut material, while opposing roll turns at 70 rpm. providing crusher, hammermill action. Three sizes: 10 to 15 tph; 25 to 100 tph; 100 to 200 tph. Cutters are easily replaced. Eagle Iron Works, Des Moines, Iowa. (6)



BOX CAR UNLOADER can now be used between two tracks to move bulk material from one car to another. Pantograph arm with scoop reaches into car until it meets an obstruction, drops down and withdraws load. Handles up to 2-in. material. Stephens-Adamson Mfg. Co., Aurora, Ill. (7)

processing; solutions to problems of pump selection for typical vacuum systems; and useful information on continuous oil purification and other maintenance procedures for high-vacuum pumps. (62)

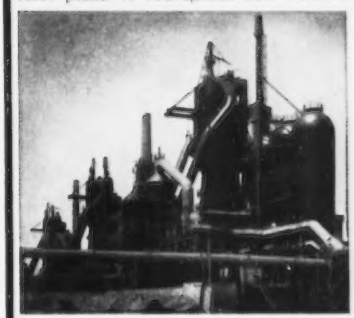
SCRAPERS. A three-color 12-page illustrated catalog has been issued by the Tractor Division of Allis-Chalmers Mfg. Co., Milwaukee, Wis., covering the line of seven modern pull-type scrapers now available. They provide a selection of pull-type earth-moving equipment with struck capacities ranging from 2 to 18 cu. yd., for use with all size crawler tractors in the field today. The catalog includes complete specifications and other pertinent data on each unit. (63)

(*Continued on page 112*)

what's NEW in Engineering

An automatic welding machine, developed by a Michigan company, is claimed to duplicate the work of dozens of human welders. The octopus-like machine generates temperatures of 2000° F.; is water cooled. One operator can make 62 simultaneous welds with it. In one minute it can perform 744 weld operations.

Reducing coke consumption while increasing pig iron production was the dual problem facing Kaiser Engineers in designing and building blast furnaces for a California steel plant. A courageous new furnace

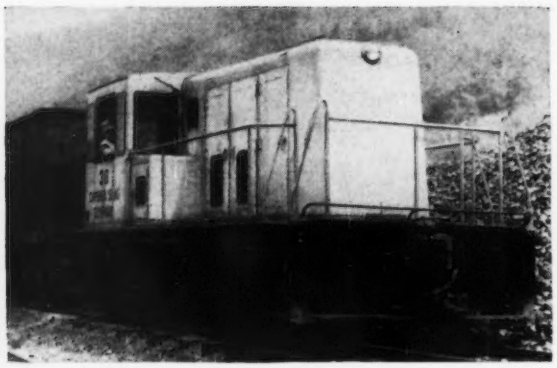


design gave record results — 1335 tons of pig iron per day on furnaces rated for 1200 tons. These furnaces use 1409 lbs. of coke per net ton of iron against a national average of 1600-1700 lbs. per ton. We'll send you a reprint of an article by Dr. W. C. Rueckel which tells how Kaiser Engineers attained this outstanding furnace practice — with savings in capital and operating costs through increased production.

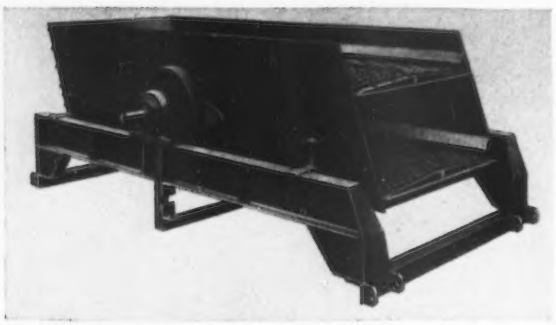
Simplified Drafting Practice, by Healy and Rau, is a best-selling new book which outlines a modern approach to industrial drafting. The method claims to cut drafting time 30-50%; reduce large blueprints to handy pocket size.

For those clients who want general consulting engineering services, such as economic studies, evaluation, investigation of manufacturing facilities, or analysis of operating costs, the full engineering experience of Kaiser Engineers is available. Call or write: Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, California.

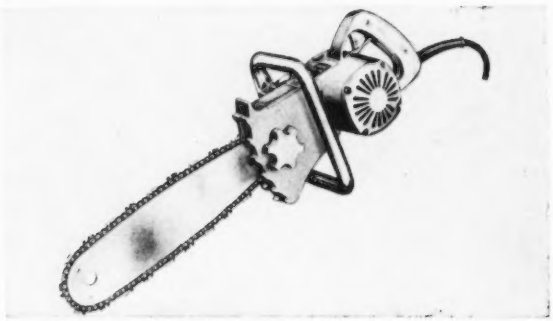
TRICYCLE TRACTOR TRAILER, Army experimental unit travels on "Rolligon" balloons or tireless tubes. Low-pressure inflation permits travel on rocky, uneven terrain, swamp, sand. Goodyear Tire and Rubber Co. (8)



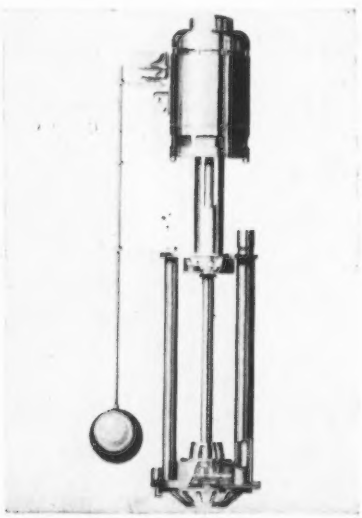
DIESEL ELECTRIC LOCOMOTIVE, a 35-ton twin axle unit, has been added by General Electric Co. to its line of industrial switchers. Starting tractive effort is 21,000 lb. at 30% adhesion. (9)



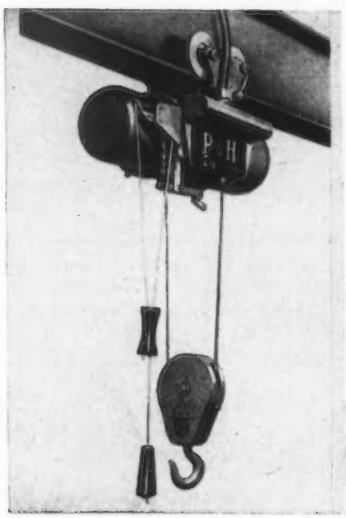
VIBRATING SCREENS, 5 ft. wide, are available in 10, 12 and 14-ft. lengths with 1, 2, 2½, or 3 decks, from Diamond Iron Works, Inc., Minneapolis, Minn. Adaptable to "V" or flat belt drive. (10)



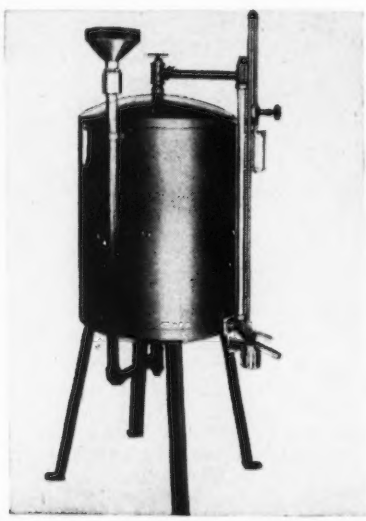
ELECTRIC CHAIN SAW, weighs 16½ lb., cuts up to 14 in. on one cut. Standard voltage is 115 v.; available at 220 v. Aluminum housing, powerful motor make for easy handling. Skil Corp., Chicago, Ill. (11)



ACIDPROOF SUMP PUMP, size 1½ in., handles acid sludges, corrosive, foamy liquids with suspended solids at 75 gpm. against 35-ft. heads. Galigher Co., Salt Lake City. (12)



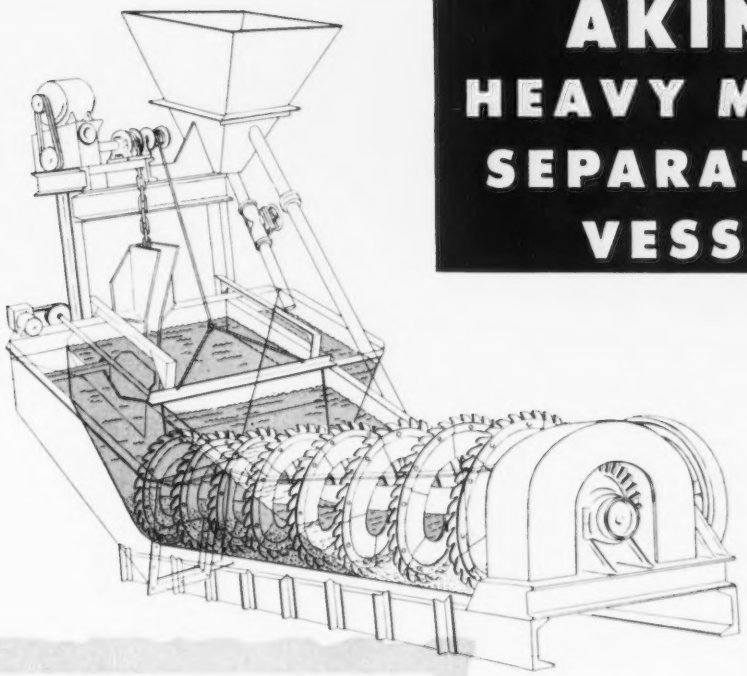
ELECTRIC HOIST (Zip-Lift) costs $199.50. Two models of 500 and 1000-lb. capacities. Both available with 12 and 18-ft. lift. One hand rope control. Harnischfeger Corp. (13)



"LIQUIFEEDER" maintains constant feed rate from less than half pint to more than 500 gal. a day as adjusted. Can be designed to handle any fluid. Hankison Corp., Pittsburgh, Pa. (14)

PROVED ADVANTAGES of

AKINS HEAVY MEDIA SEPARATORY VESSEL



ENTIRE VESSEL IS VISIBLE

The Akins vessel is fully open for visual inspection and all wearing parts are easily accessible. It is a simple matter to sample any portion of the separatory pool or any of the products to check density or degree of separation. Due to the open construction, any slight modification that might be required to improve separation can be easily made. The tank is bedded with solids so it does not wear.

OTHER OUTSTANDING ADVANTAGES OF AKINS

Large pool area and volume facilitate better recovery of values from fine sizes.

Variation in feed rate or grade of feed is not detrimental.

No intermixing of sink and float in product discharge.

Circulation of media at lower gravity and viscosity.

Gradation of gravity and viscosity from feed entry point to sink removal point provides natural cleansing of sink.

Three product separation in one machine.

Akins—the ORIGINAL spiral type classifier.

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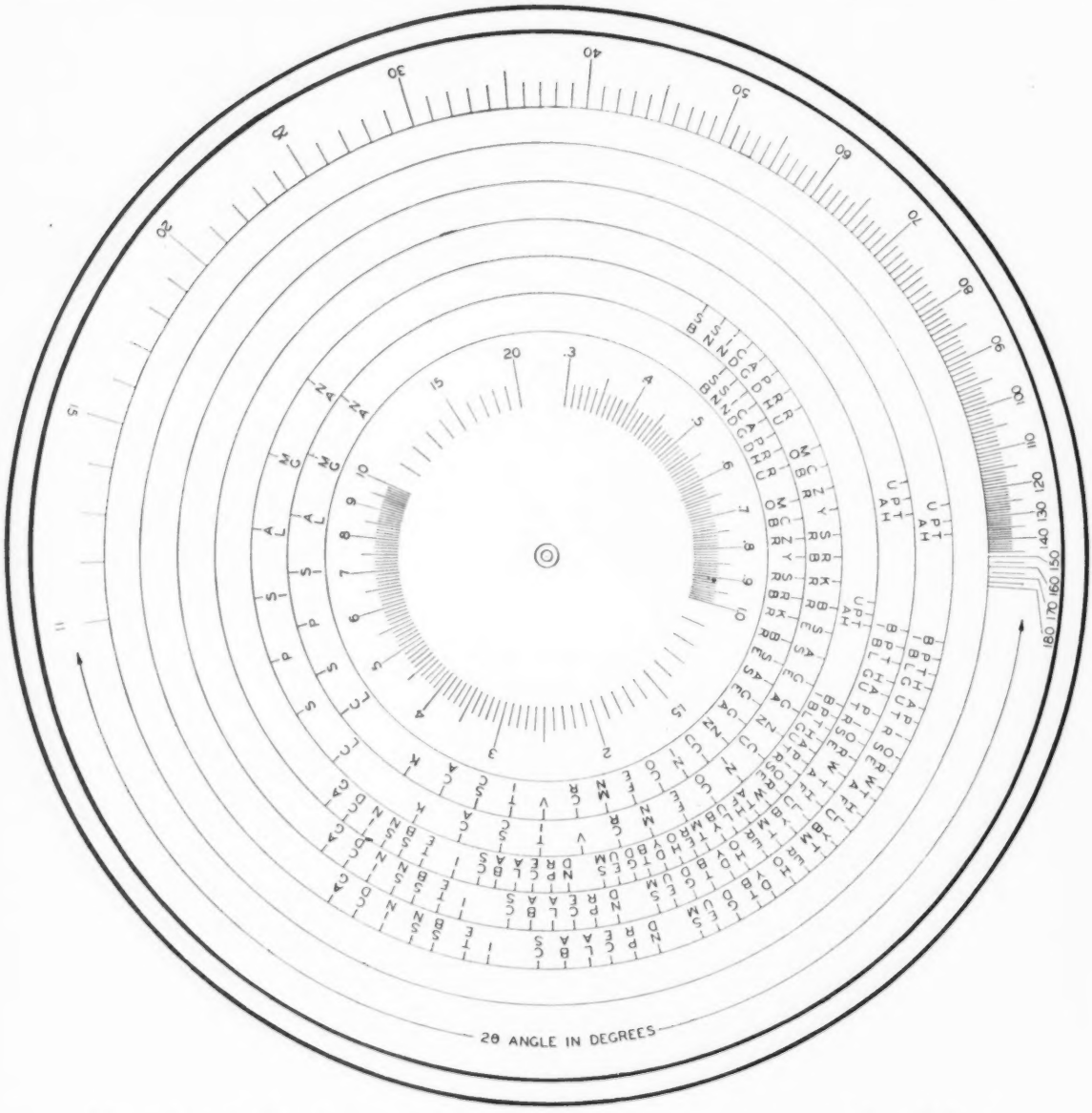


Handy Calculator for X-Ray Spectrographic Work

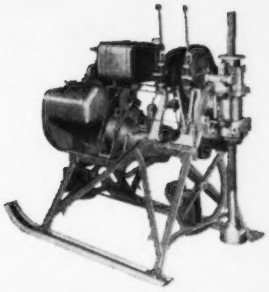
THIS CALCULATOR WAS designed by V. W. Palen, Research and Control Instruments Division, North American Philips Co., Inc., and is being published for X-ray spectrograph (fluorescence analysis) users in the mining field.

To assemble, mount the two circular disks on cardboard with rubber cement, then use a razor blade to cut out the window for elements and wavelengths. Accurately punch holes at the disk centers and use a small nut and bolt with washers to hold the assembly together. Tighten the nut so the disks rotate freely, then solder or rivet the bolt end for permanence.

In use, the X-ray spectrograph identifies an element in a given specimen by means of a recorded intensity reading on a strip-chart. The intensity readings appear as peaks on a hill-and-valley curve whose horizontal axis is graduated in degrees. Angular location of the peaks is the means for identifying elements from sodium (atomic No. 11) to uranium (atomic No. 92).

Various analyzing crystals and groups of X-ray intensities may be used in X-ray spectrograph analysis work. The choice for a particular job depends on the nature of the problem at hand. Using known conditions in the set-up and angular readings from the instrument chart, the calculator quickly indicates the identity of

(Continued on p. 116)

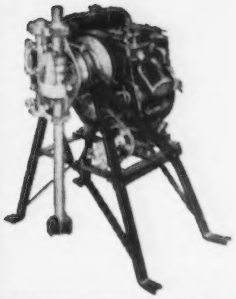


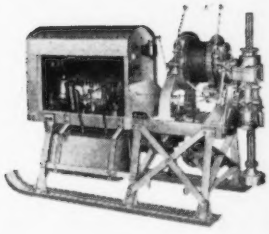
BBS-1

World's best known surface drill. Handles "E" rods to 1000 ft. "A" to 800 ft.

X-RAY

Compact, portable - - 185 lbs. net. Takes ¾" core to 200 ft. Low fuel consumption.



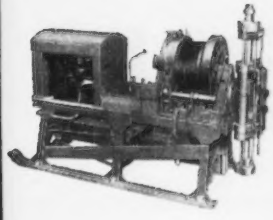


BBS-2

Versatile, choice of 5 swivelheads. Depths to 2400 ft. Gas or diesel.

BBS-4

Drills to 5000 ft. with "B" rods. Moves under own power. Gas or diesel.

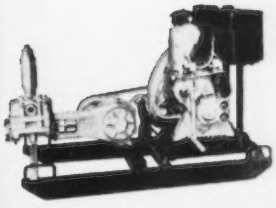


PERMASET BITS

(Powdered metal). All standard sizes available from stock. Also reaming shells, etc.

DRILL PUMPS

5-12 and 4-7 models. Capacities 400 to 1200 g.p.h. Diesel motor optional on 5-12.



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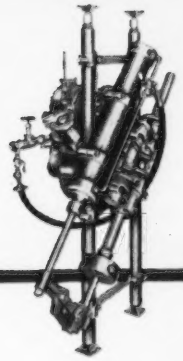
WE LOOK INTO THE EARTH

BOYLES BROS
DRILLING COMPANY LTD.
VANCOUVER, CANADA

...WE MAKE IT!

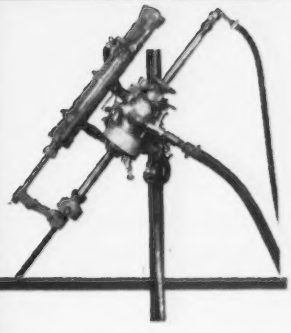


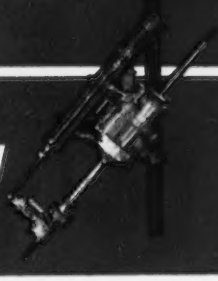
BBU-2

Rugged. Capacity, 1800 ft. with "E" rods, 1400 with "A". Four gear feeds.

VB and VC

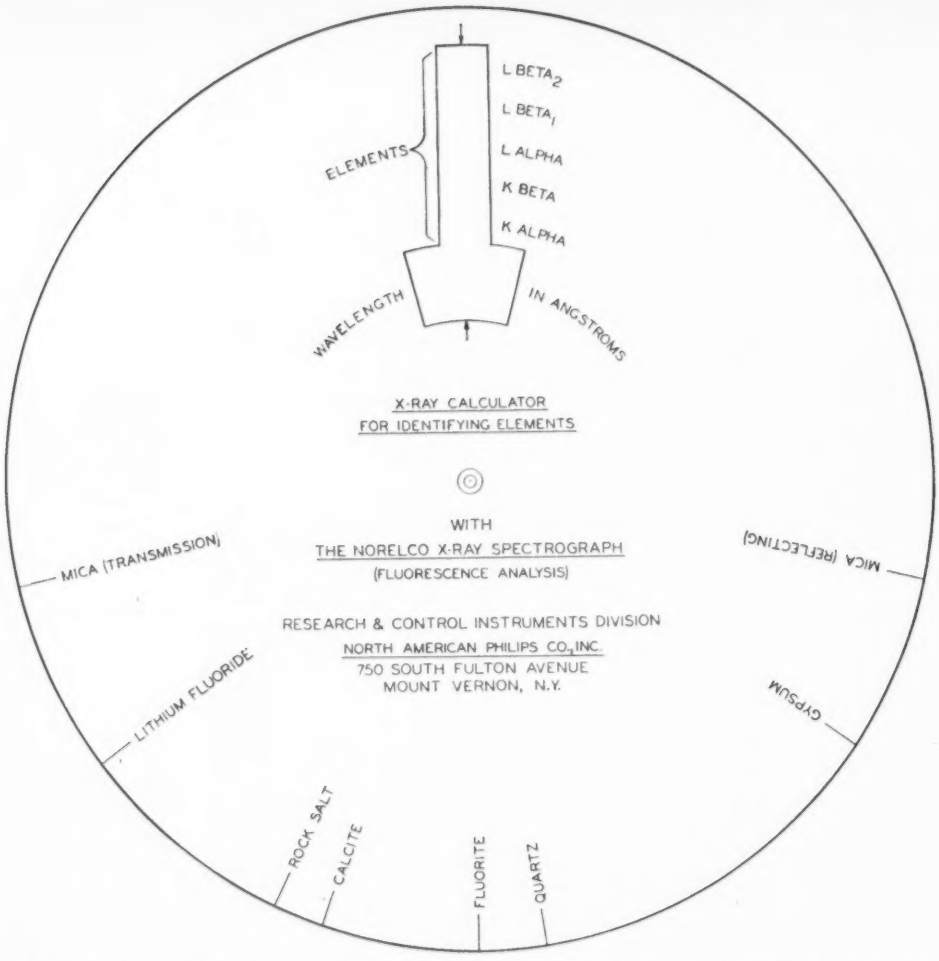
6" vane motor, 4 feed swivelhead. 2 forward 1 reverse speed transmission for blasthole or coring to 800 ft. (E size).





JV

4 feed swivelhead. Capacity 800 ft. with "E" rods. JVR with reverse and right hand feed screw for blastholes.

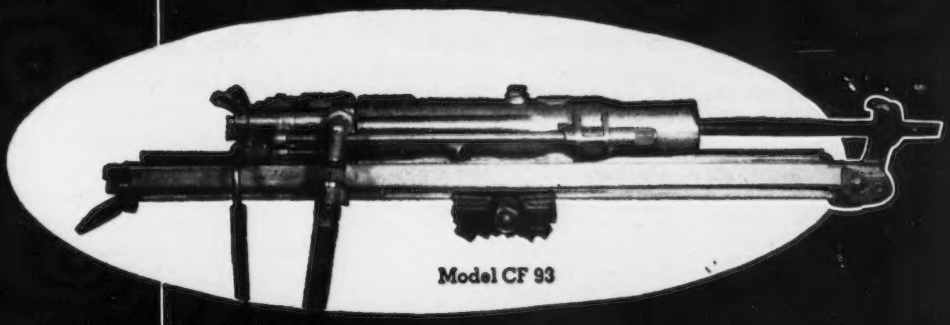


elements along with corresponding wavelengths.

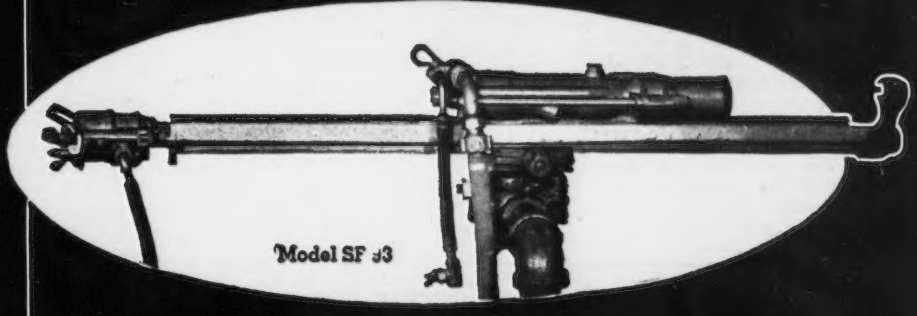
EXAMPLE: Suppose the X-ray spectrograph is employing a mica (reflecting) analyzing crystal and the chart shows intensity peaks at angular positions of approximately 71 deg. and 72 deg. Set the mica (reflecting) mark on the calculator opposite 71 on the angular scale. Read Na (Sodium) in the window (K Beta) and about 11.5 Angstroms wavelength. Now, set mica (reflecting) mark opposite 72 on the angular scale. Read Na (Sodium) in the window (K Alpha) and approximately 11.9 Angstroms in wavelength.

Atomic Numbers and Names of Elements Used on Calculator for the X-Ray Spectrograph

11 – Na – Sodium
12 – Mg – Magnesium
13 – Al – Aluminum
14 – Si – Silicon
15 – P – Phosphorus
16 – S – Sulphur
17 – Cl – Chlorine
19 – K – Potassium
20 – Ca – Calcium
21 – Sc – Scandium
22 – Ti – Titanium
23 – V – Vanadium
24 – Cr – Chromium
25 – Mn – Manganese
26 – Fe – Iron
27 – Co – Cobalt
28 – Ni – Nickel
29 – Cu – Copper
30 – Zn – Zinc
31 – Ga – Gallium
32 – Ge – Germanium
33 – As – Arsenic
34 – Se – Selenium
35 – Br – Bromine
36 – Kr – Krypton
37 – Rb – Rubidium
38 – Sr – Strontium
39 – Y – Yttrium
40 – Zr – Zirconium
41 – Cb – Columbium
42 – Mo – Molybdenum
44 – Ru – Ruthenium
45 – Rh – Rhodium
46 – Pd – Palladium
47 – Ag – Silver
48 – Cd – Cadmium
49 – In – Indium
50 – Sn – Tin
51 – Sb – Antimony
52 – Te – Tellurium
53 – I – Iodine
55 – Cs – Caesium
56 – Ba – Barium
57 – La – Lanthanum
58 – Ce – Cerium
59 – Pr – Praseodymium
60 – Nd – Neodymium
62 – Sm – Samarium
63 – Eu – Europium
64 – Gd – Gadolinium
65 – Tb – Terbium
66 – Dy – Dysprosium
67 – Ho – Holmium
68 – Er – Erbium
69 – Th – Thulium
70 – Yb – Ytterbium
71 – Lu – Lutecium
72 – Hf – Hafnium
73 – Ta – Tantalum
74 – W – Tungsten
75 – Re – Rhenium
76 – Os – Osmium
77 – Ir – Iridium
78 – Pt – Platinum
79 – Au – Gold
80 – Hg – Mercury
81 – Tl – Thallium
82 – Pb – Lead
83 – Bi – Bismuth
90 – Th – Thorium
91 – Pa – Protactinium
92 – U – Uranium



Model CF 93



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Maintains correct bit pressure *automatically* — regardless of ground changes.
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THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

MARKETS—Trends and Prices (*Continued from page 69*)

U. S. Copper Imports Substantially Higher

Imports of crude and refined copper in the first half of 1953 totaled 373,090 tons; about 21% above the rate established in the preceding year, according to data compiled by the American Bureau of Metal Statistics.

Deducting exports to arrive at net imports, the increase over 1952 was even greater, amounting to 54%. Exports in the Jan.-June period of 1953 totaled 35,468 tons, which contrasts rather sharply with 174,783 tons exported during all of 1952.

The increase in the rate of imports of copper contained in ore, matte and regulus was slight, but both blister and refined scored large gains. Imports of refined copper from Chile decreased, compared with a year ago, but this loss was offset to some extent by larger receipts of blister. Imports from countries that figure prominently in the statistics include Northern Rhodesia, the Belgian Congo and Belgium, and Canada.

Copper imports for 1952 and the first six months of 1953, in tons:

	Jan.-Dec. 1952	Jan.-June 1953
Ore, matte & regulus (content)	105,196	56,608
Blister copper (content)	162,189	122,077
Canada	26,463	3,494
Mexico	36,830	18,842
Chile	55,543	63,813
Yugoslavia	8,022	.....
Northern Rhodesia	28,224	26,133
Union of South Africa	3,326	.....
Turkey	3,779	7,353
Australia	.....	1,674
Others	2	768
Refined cathodes and shapes	346,958	194,405
Canada	28,324	44,546
Mexico	5,840	6,081
Chile	294,425	118,862
Peru	1,663	3,874
Belgium	646	3,965
Germany (West)	8,931	3,235
Sweden	.....	1,547
United Kingdom	37	838
Yugoslavia	6,811	4,730
Belgian Congo	.....	3,149
Australia	.....	2,543
Others	281	1,035
Total imports	614,343	373,090

Zinc Stocks Rising

The August statistics of the American Zinc Institute showed that stocks in the hands of smelters increased 13,991 tons to 117,897 tons, the highest level since September 1947.

Production in August totaled 83,241 tons, which, combined with continued large imports, resulted in a rather top-heavy supply situation.

A summary of the July and August statistics, figures in tons, follows:

	July	August
Stock at beginning	97,285	103,906
Production	80,825	83,241
Production, daily rate	2,607	2,685
Shipments:		
Domestic	69,498	65,450
Export-drawback	94	428
Government acc't	4,612	3,372
	74,204	69,250
Stock at end	103,906	117,897
Unfilled orders	32,327	32,988

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

Sept. 30, 1953

Aluminum ingot, 99 plus percent, lb.	21½¢.
Antimony, spot, lb., 5 tons and up but less than carload, packed in cases	37.97¢.
Bismuth, ton lots, lb.	$2.25
Cadmium, commercial sticks, delivered, lb.	$2.00
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.18
Cobalt, 97 to 99 percent, per lb.	$2.40
Germanium, lb.	$295.00
Indium, troy oz.	$2.25
Lithium, lb., 98 percent	$11.00 @ $14.00
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	60¢.
Magnesium, 99.8 percent, carloads, lb., producer's plant, Freeport, Texas	27¢.
Palladium, troy oz.	$22.00 @ $24.00
Platinum (Official quotation wholesale lots) troy oz.	$92.00 @ $93.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$184 @ $186
Selenium, 99 plus percent, lb.	$4.25 @ $4.75
Silicon, minimum 97 percent, carloads, lb.	18½¢.
Tellurium, lb.	$1.75
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 99.3 plus, lb.	$5.00

(a) Includes U.S. duty.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per unit	$46.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry	
44% Cr_2O_3 no ratio	$27.00 @ $32.00
48% Cr_2O_3 3 to 1 ratio	$44.00 @ $55.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer (b)	$10.30
Mesabi bessemer (b)	$10.05
Mesabi, non-bessemer (b)	$9.90
Lead (Galena), 80 percent, Joplin, Mo., ton	$166.50
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, $1.14 @ $1.16 c.i.f. U.S. ports, duty extra. Long-term contract nominal at 90c. to 93c., c.i.f. duty extra.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	60¢.
Tantalite, 60% concentrate, per lb.	$2.50 @ $3.00
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, c.i.f. U.S. ports	$41.00 @ $42.00
Domestic, scheelite, 60 percent f.o.b. mill	$63.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	31¢.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$56.00

(a) F.o.b. port of shipment. (b) Effective July 1, 1953.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	5½¢.
Cobalt Oxide, 72½% to 73½%, ceramic grade, per lb.	$1.82 @$1.84½
Copper Sulphate, 100 lb.	$10.35
Germanium Oxide, lb.	$142.00

ALLOYS

Ferrochrome, 65 to 69 percent, per lb. of Cr contained	24¾¢.
Ferromanganese, 74–76%, net ton, seaboard	$200
Ferromolybdenum, 55 to 65 percent Mo. lb. of Mo. contained	$1.32
Ferrosilicon, 50 percent per lb. of contained Si	12.4¢.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$4.35
Ferrovanadium, per lb. of V delivered	$3.00 @ $3.25
Silicomanganese, Max. 1½ percent carbon, per lb. contracts	11.4¢.
Spiegeleisen, per long ton, 19 @ 21% grade	$86.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:	
Crude No. 1	$960 @ $1,500
Crude No. 2	$595 @ $900
Spinning fibers	$321 @ $514
Shingle fibers	$150 @ $200
Paper stock	$109 @ $137
Waste	$77
Shorts	$35 @ $70
Asbestos, Vermont, f.o.b. Hyde Park:	
Spinning fibers	$279.50 @ $302.00
Shingle stock	$135.00 @ $162.00
Paper stock	$81.50 @ $115.00
Waste, stucco or plaster	$71.40
Refuse or Shorts	$34.00 @ $63.00
Barytes, f.o.b. cars:	
Georgia, crude, per ton	$14.00
Missouri, 94 percent $BaSO_4$, per short ton	$13.25
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 52 percent (not dried) (a)	$5.00 @ $5.50
Domestic, chemical, 55 to 58 percent (a)	$8.50 @ $9.50
Domestic, abrasive, 80 to 84 percent (a)	$18.00 @ $18.50
China Clay, f.o.b. mines, ton:	
Georgia, filler and ceramic grades	$8.50 @ $9.50
North Carolina ceramic grade	$20.25 @ $22.25
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @ $22.25
Glass feldspar, white, 20 mesh	$11.75 @ $12.50
Fluorspar, f.o.b. mines, bulk, 70% effective ton	$42.50
60% effective CaF2	$38.00
Acid 97% concentrate, bulk, ton	$60.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @ $14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$39.56
Mica—Domestic, f.o.b. mines. Punch 12 to 22¢. per lb. according to size anp quality. Sheet clear, 1½ x 2 inch, 70¢. to 85¢.; 2 x 2 inch, $1.10 to $1.60; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet, ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton Scrap $32 and up.	
Ocher, Georgia, ton, in sacks	$30.00
Pyrites, Spanish, per long ton unit of S. c.i.f. Atlantic ports	Not quoted
Sulphur, Texas, mines, long ton	$25.50 @ $27.50
Talc, f.o.b. works, ton:	
New York, purified	$18.50 @ $20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$30.00

(a) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces	$56.00
Steel f.o.b. Pittsburgh, billets, net ton	$62.00
Structural shapes, 100 lb.	$4.10

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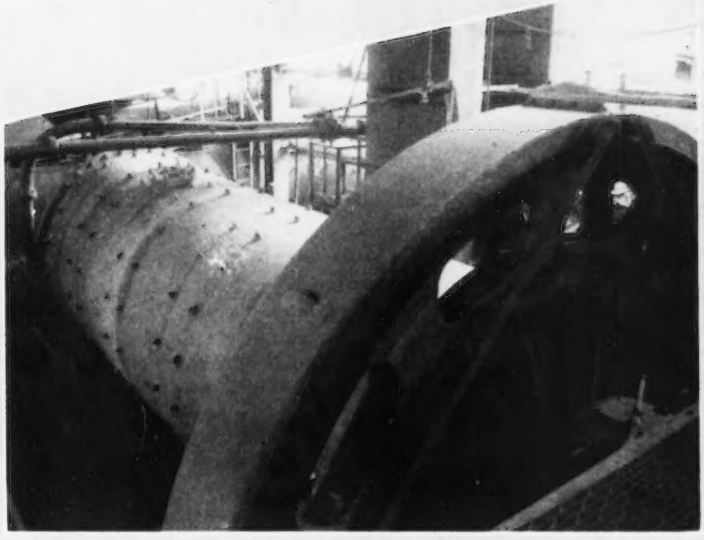

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The 9′6″ x 9′ mill was installed as a preliminator in closed circuit with a classifier to handle 2,000 tons per day ¾″ to 1″ raw feed...the 9′6″ x 25′ mill in secondary circuit for making a product 90% through 200 mesh.

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The Audit Bureau of Circulations is a voluntary, non-profit, cooperative association. It was founded in 1914 and now consists of 3450 advertisers, advertising agencies and publishers in the United States and Canada. This magazine is proud to be a member.

ABC originally was set up to help take the racket out of publishing, to eliminate the waste and guesswork then so prevalent in publishing and advertising, to establish order and confidence in place of the misunderstanding and misrepresentation that arose from unverified circulation claims and dubious circulation practices. Its mission was to protect the interests of both readers and advertisers.

THIS IT DID by first defining the term "paid circulation." Then it established standards and rules to govern subscription sales practices and records. Finally it set up an auditing organization to verify the claims and report the facts concerning the circulation of each member publication. It now maintains on that job a working staff of sixty-five full-time auditors. So the ABC symbol has become the hallmark of circulation standards and advertising values. Each member publication must maintain those standards if it wishes to retain its membership and display the ABC symbol.

This ABC audit is no perfunctory affair. When a business publication, such as this one, becomes a member of the Bureau, it agrees that the auditors shall have "the right of access to all books and records." Their inspection, therefore, may cover any part of its operations. Original subscription orders, payments from subscribers, paper purchases, postal receipts, arrears of payments, and many more items are painstakingly checked by the auditors. In many instances they go behind the records to seek verification from subscribers themselves as to the terms of their subscriptions.

IN DOING ITS JOB, ABC has created many values for both publishers and readers as well as for advertisers. That is because the publication that becomes a member of ABC thereby offers the strongest possible guarantee of its primary devotion to the interests of its readers. The function of a business magazine is to be useful to its readers. When this service is rendered by an ABC publication, it is constantly subject to the practical test of reader acceptance and approval. As each subscriber has the right to purchase or refrain from purchasing an ABC publication, that collective right confers upon the readers the power to say whether or not the publication will survive. Thus the report on its ABC audit provides the most direct assurance that a publication stays in business only because of a voluntary demand by readers who find its editorial service responsive to their needs.

Naturally, the editor of each business publication follows closely the score thus racked up by his paper in its ABC reports. In the scope and tone of his editorial coverage and treatment, in the selection and presentation of his editorial content, he must constantly labor to maintain and enhance the readers' acceptance of his efforts. That is why the editorial standards established by ABC publications set the editorial standards for all publishing. That is how the ABC constantly stimulates its member publications to become even more useful to their readers.

AND THAT IS WHY the ABC symbol has become the Mark of the Reader, a constant reminder that his willingness to pay for an ABC publication is the acid test of its value both to him and to its advertisers.

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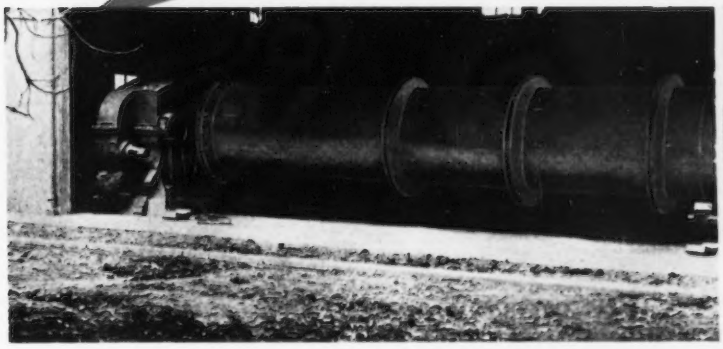
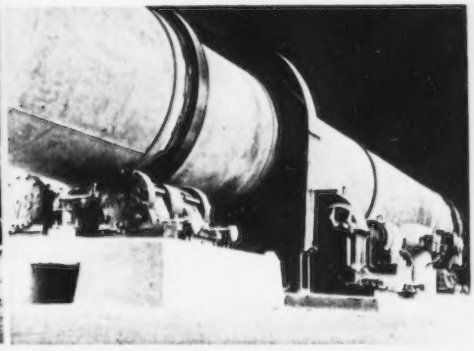


70'x40', 3 compartment Tube Mill, with Integral Gear Drive, grinding clinker.



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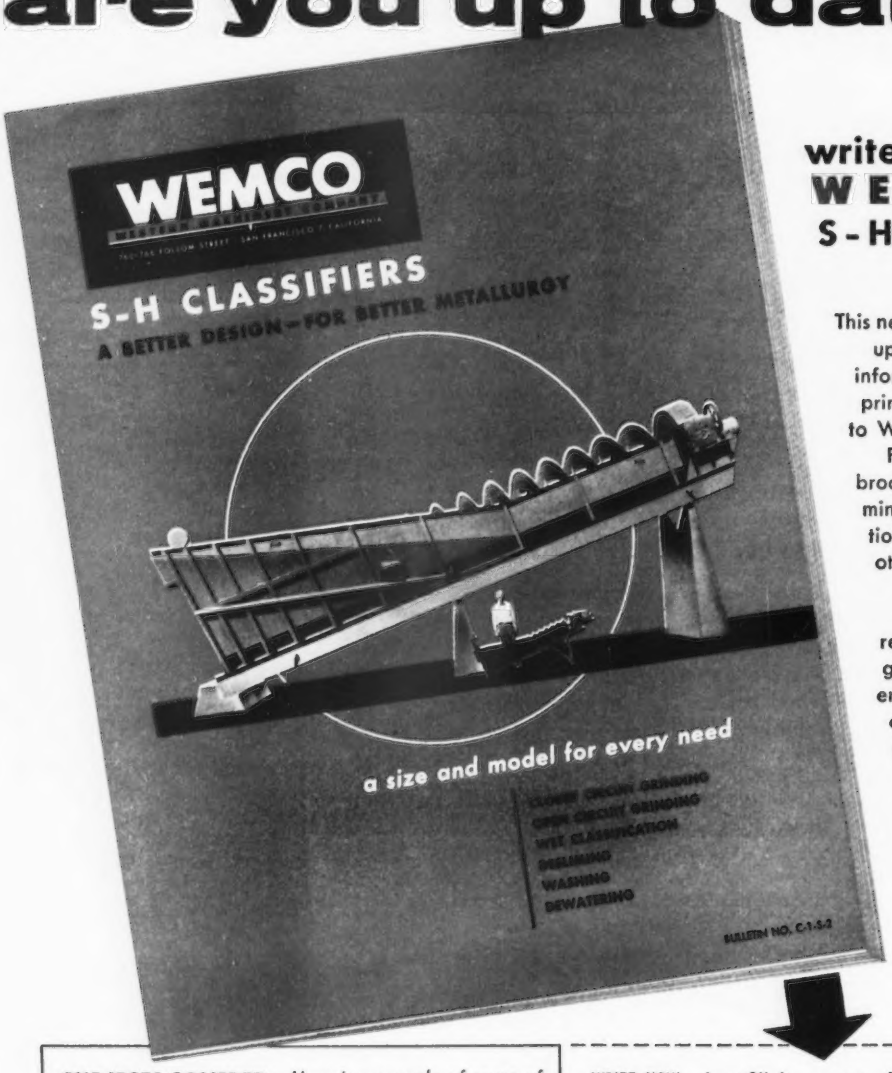

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CHARLES H. THURMAN
Consulting Gold Dredging Engineer

CHARLES HUBBARD THURMAN was born and reared on a grain farm in Tulare County, Calif. At the age of 13, he left school and became a teamster, ending his formal schooling. On April 8, 1901, a few days after his 18th birthday, he went to work as a teamster for the Bear River Mining Co., one of the several gold dredging companies organized by the late W. P. Hammon, father of California gold dredging, with whose companies Thurman was to be associated in various capacities for the next 14 yr. of gold dredging operations. And, for more than 50 continuous years he has been and is still active in all phases of gold dredging, from the development of placers to the construction and operation of 27 different gold dredges, and progressing from oiler, winchman, dredgemaster, superintendent, and manager to owner and president of his own dredge companies in California.

At the age of 21, with three years experience in general gold dredging operations, Charles Thurman was placed in charge of dismantling three gold dredges on the Bear River, then was transferred to the Yuba River operation of the Yuba Cons. Gold Fields near Marysville, Calif., which was to be the proving ground for the construction and development of deep-digging bucketline dredges.

In the Yuba River field he assisted in drilling the first prospect holes and in building and operating the first seven of a fleet of 21 deep-digging gold dredges, in this, the most extensive gold dredging field in the world. Thurman advanced to the position of dredgemaster at the age of 24.

In 1910, at 27, he was made superintendent in charge of 8 gold dredges and two machine shops on the Feather River at Oroville, Calif., under four companies, all organized and managed by Mr. Hammon.

In 1914, he became division manager for the Natomas Company of California (Feather River Division), which completed mining all of its property in that field in 1925. One remaining dredge was purchased by Thurman and subsequently operated under the name of Thurman Gold Dredging Co., Inc., until 1928, when the ground was exhausted, the dredge sold, and the company dissolved. It was this 7½-cu. ft. Yuba dredge which, under his management, established a record for low operating cost, believed never bettered. From 1914 to 1927 some 23,257,712 cu. yd. of gravel were mined at a cost of 3.25¢ per cu. yd. In this same period two 7½-cu. ft. dredges and one 15-cu. ft. Yuba dredge belonging to Natomas mined 62,978,505 cu. yd. at a cost of 3.46¢ per cu. yd. after taxes and insurance but before depreciation, depletion and income tax.

In 1931, Thurman became associated with other experienced gold dredge operators, and incorporated the Snelling Gold Dredging Co., of which he is president. Two 7½-cu. ft. dredges were built and put into operation on the Merced River at Snelling, Calif. In January, 1952, the company completed mining all of its ground, some 60,512,762 cu. yd., and is now in the process of liquidating all of its assets preparatory to disincorporating. Dredge No. 2, built by Yuba Manufacturing Co., mined 20,297,241 cu. yd. from 1935 to 1942 at a cost of 3.50¢ per cu. yd. before depreciation, depletion, and income tax.

From 1934 to 1936, Charles Thurman was employed as operating manager for the Gold Hill Dredging Company of San Francisco, operator of three gold dredges in California. He resigned that position to open an office in San Francisco, where he has since been engaged in general dredge consulting work and as president and manager of three gold dredging companies in which he owns substantial interests. In 1936, he was retained as consulting engineer for the Williams Bar Gold Dredging Co., and in this capacity a special 6-cu. ft. double-stacker dredge for river improvement and gold mining was built to his specifications in 1937 on the Yuba River near Smartsville. This unit mined 15,000,000 cu. yd. of gravel and completed its operation in 1942. In 1945, the dredge was purchased by Thurman & Wright (partnership composed of Mr. Thurman and A. J. Wright), and was moved to the Cosumnes River in Sacramento County. It completed mining available ground in 1949 and was then sold and shipped to British Guiana, S. A., where it is now in operation. In 1937, the Lewiston Gold Dredging Co. was formed, and operated a 7-cu. ft. dredge for several years on the Trinity River near Lewiston, Calif., under Thurman's management.

In 1940, the second Thurman Gold Dredging Co. was incorporated, with Thurman as president and manager and with several of his former dredging associates and employees as directors and stockholders. Under his guidance and with the assistance of the late L. D. Hopfield and F. J. Estep, specifications for an 8½-cu. ft. bucketline dredge were drawn. The unit, designed and built by Yuba, was sectionalized; each part small enough to permit transportation by truck and quick assembly at the dredging site. The dredge was trucked from the Benicia plant of Yuba Manufacturing Co. to Clear Creek near Redding in Shasta County, a distance of 200 miles, where it was put into operation in 42 days.

Included in the design were several features designed to bring about lower operating costs, greater efficiency, and elimination of lost operating time. Some of these are an independent ladder hoist with automatic magnetic-electric brake; Cline-Pickard revolving, perforated screen save-all in place of conventional grizzly bars; oversize shafting and bearings; dual V-belt motor drive on the main gearing; and well hole housing wide enough for a gangplank with safety railing to be attached to the box-type digging ladder, to permit greasing of all upper ladder rollers while the dredge is in full operation.

The additional cost of the extra-heavy machinery and structural steel parts and special features amounted to about $51,000 over a standard dredge of like size. This inital cost amounted to two tenths of 1 cent per cu. yd. but effected a saving of at least 1 cent per cu. yd., or $252,846, in the operating costs for the entire 25,284,611 cu. yd. mined.

The dredge completed its operation in Calif. during April, 1951, and was shipped to Brazil in 1952, where in 1953 it will be used by Dragagem de Oure, Limitada, in which Thurman and his associates will be interested.

At 70 Charles Thurman is still very much in the gold dredging business. He believes that gold will soon command a better price than $35.00 an oz., and that dredging will continue a long time throughout the world wherever there are suitable placers. He further believes that the modern gold dredge with its many refinements, and under efficient management, is one of the safest mining investments because only in this type of gold mining can production, capital investment, and profits be determined before the capital investment is made.

PERSONAL NEWS

The appointment of **Dr. Reinhardt Schuhmann, Jr.** as professor of Metallurgical Engineering, beginning with the second semester of the 1953-54 academic year, is announced by the School of Chemical and Metallurgical Engineering of Purdue University. Prof. Schuhmann, who is now associate professor of Metallurgy at the Massachusetts Institute of Technology, where he has served since 1935, will become department chairman at Purdue. He is a member of the American Institute of Mining and Metallurgical Engineers, American Society for Metals, American Chemical Society and author of the textbook, "Metallurgical Engineering."

Dr. Francis Birch, Sturgis-Hooper professor of Geology at Harvard University and chairman of the Committee on Experimental Geology and Geophysics there, has been appointed chairman of the Division of Earth Sciences of the National Research Council, Washington, for the year 1953-54.

C. H. Rieman, who has been associated with Gardner-Denver Company for the past 16 years, was recently appointed sales manager of the Mining and Construction divisions. In 1951, Mr. Rieman was named sales manager of the Mining division at the home office in Quincy. He was appointed to his present position upon the retirement of **R. H. Pearson,** who was vice president and sales manager of the Construction and Oil Field divisions.

Don W. Blend, general manager of the Wolverine Tube division of Calumet and Hecla, Inc., has been elected a vice president of the company, it was announced by **Endicott R. Lovell,** president.

E. R. RAMSEY, president of the Dorr Co. since 1949, has retired from that position and ended 39 years of active service with the Conn. engineering firm. He has been elected vice-chairman of the board, will continue as a director of the firm and will serve it as consultant. Mr. Ramsey has been a director of the company since 1935.

DR. ELLIOTT J. ROBERTS (left) who has been named technical director in charge of research, development at Dorr Company's Westport Mill, will be succeeded as director of research by BRYANT FITCH (center). FRANK A. DOWNES (right) is retiring as vice president in charge of research and development.

John F. Cole, New York City, secretary and assistant treasurer of the Butte Copper & Zinc Co., with producing properties at Butte, Mont., was elected a director to succeed the late **Eugene K. Garey.**

A. B. Martin, Butte, Mont., mining engineer, has resigned as chief engineer with the Montana Power Co. to become research consultant with the Washington Water Power Co. at Spokane.

During the college year 1953-54, activities of the mineral engineering education division of the American Society for Engineering Education will be directed by the following officers: **W. J. Rundle,** chairman, University of Wisconsin; **W. R. Chedsey,** vice chairman; **J. W. Stewart,** secretary; and **C. L. Wilson,** member of the council for 1954.

George Dunn and **Harold Lee** have been named to new positions at the Bunker Hill lead smelter following the retirement of **J. B. Schuettenhelm,** smelter superintendent. Mr. Dunn has been named superintendent of operations and Mr. Lee, superintendent of Metallurgy and research.

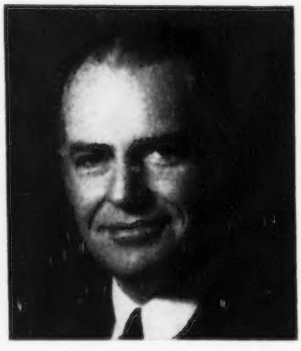
A. E. Haesler, former general superintendent of the Mike Horse Mining and Milling Co., is now superintendent of the Leadville, Colo., district mining operations for the American Smelting and Refining Co.

Barney B. Greenlee of Leadville, Colorado, general manager of the Resurrection Mining Co. for the past seven years, has left for Hope, British Columbia, where he will be general manager of the Western Nickel Mining Company, a subsidiary of the Newmont Mining Corp.

R. H. B. Jones has been appointed consulting geologist for the Oliver Iron Mining Division. He has been with Oliver since 1930.

Francis M. Bohan, electrical supervisor of Minnesota mines for the M. A. Hanna Co., was elected president of the Electrical division of the Open Pit Mining Association at its annual convention in Terre Haute, Ind.

David A. Goodkind, president of Ringwood Iron Mines, Inc., announced the election of three new members to the firm's board of directors. The new directors are: **Alexander Rittmaster,** partner of Thompson and Rittmaster and director of Merritt-



J. DELANO HITCH, former executive vice-president of the Dorr Co., was elected president of the organization and took office a few weeks ago. Mr. Hitch joined the Stamford, Conn., engineering firm after his graduation from Harvard in 1927, as a field engineer. In ensuing years, he served as sales engineer, Far Eastern representative, export manager, vice-president in charge of sales and executive vice-president. In 1946, he became a director of the company.

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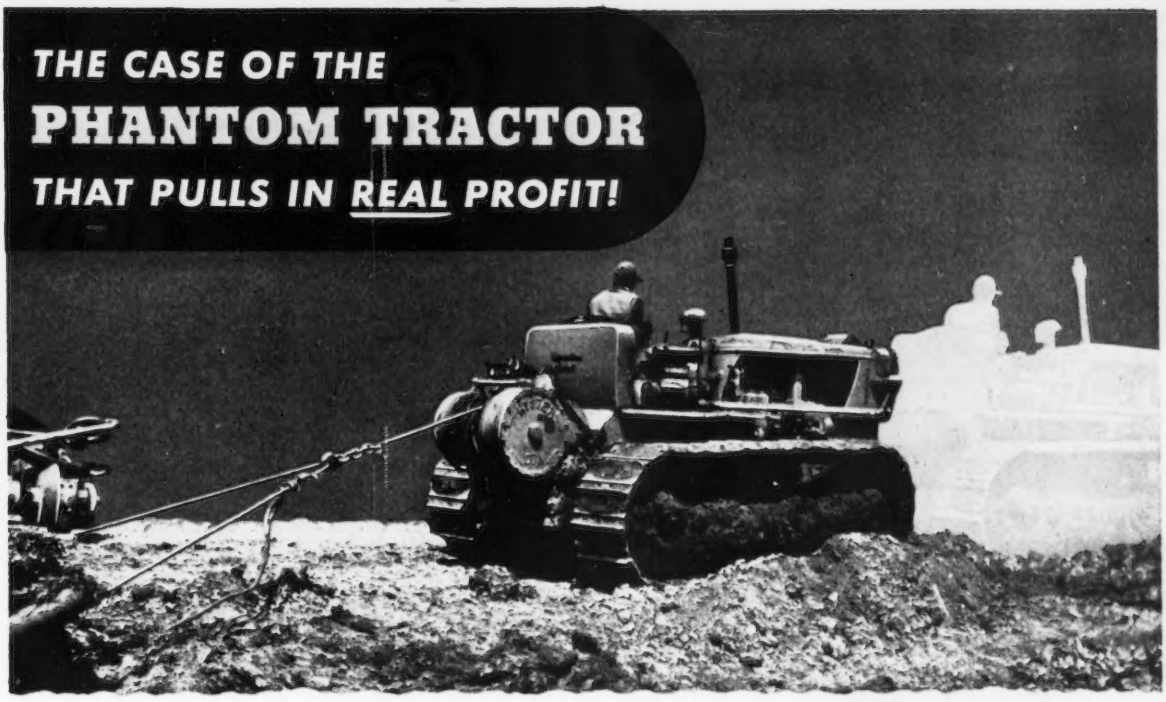

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Hyster Winches increase tractor pull up to 92% over drawbar pull!

Full tractor engine power can be extended the length of the winch-line. Permits tractor to reach out and rescue stuck equipment, pull in logs or heavy objects. Saves time and keeps jobs going in all kinds of weather.

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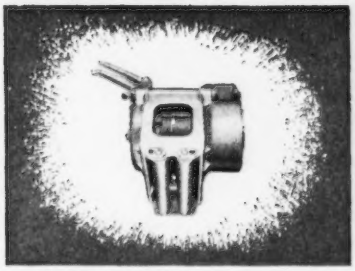
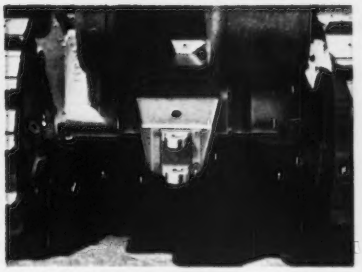
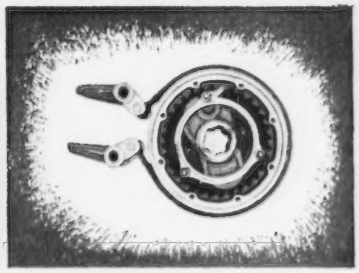


FAIRLEAD ASSEMBLY saves time maneuvering the tractor into yarding position. Reduces wear to winchline and tractor crawler assembly and saves fuel. Permits yarding from any angle to the rear of the tractor without the necessity of leading winchline straight from load to drum. (Optional for Models D8L, D7N, D6N)



BUILT-IN DRAWBAR provides added strength and rigidity to withstand severe vertical stresses encountered in arch logging and certain types of heavy-duty service. Yoke can be set in swiveling or non-swiveling (fixed) position. (Standard equipment on Model D8L, optional on D7N, D6N)



AUTOMATIC BRAKE, of special patented design, permits operator to pre-set brake before winching in a load—eliminates need for close coordination in controlling brake and clutch. For added safety, all brakes can hold loads greater than winchline capacity. (Optional on Models D8L, D7N, D6N)

HYSTER...the most complete line of tractor winches on the market!

ARCHIE GARWOOD (left) and CLARE GERLACH, who lease a part of Charles Steen's Mi Vida uranium mine, located near Moab, Utah, are seen at the mine. Mr. Garwood and Mr. Gerlach operate the mine as the G. & G. Mining Co.

Chapman & Scott Corp., New York Shipbuilding Corp., Nesco, Inc., and Gera Mills; **Paul H. Hershey,** president and treasurer of Hershey Metal Products, Inc., and director of Cobalt Consolidated Mining Corp., Ltd., of Toronto, Merritt-Chapman & Scott Corp., Derby Gas & Electric Corp., Plastic Wire and Cable Co.; and **Arnold Kramer,** president of Kramer Bros., New York City.

Promotions announced by Pickands, Mather & Co. on the Menominee Range are: **Wayne E. Seppanen,** Caspian, chief district mining engineer, has been appointed assistant general superintendent for the company's Menominee Range mines; **Richard Brewer,** assistant chief district mining engineer, has been made chief district engineer. Both appointments became effective August 1. **Milton Choquette,** mining captain at the Buck group in charge of development work, becomes mining captain at the new Lawrence Mine at Crystal Falls.

The M. A. Hanna organization has announced the recent promotions of three members of the mining staff. **Donald H. Olson,** mining engineer, has become foreman at the Carlz mine: **Cyril A. Pederson,** is now foreman at the Perry mine and **John Johanix** foreman at the South Agnew mine.

Recent promotions at the Cleveland-Cliffs Iron Co. are: **W. A. Pakkala,** district superintendent, to general superintendent of the Mesabi range mines; **R. E. Magnuson, Jr.,** chief mining engineer on the Mesabi, to administrative assistant; **W. J. Michels,** district engineer, to chief mining engineer and **Lauren K. Hanson,** mining engineer, to district engineer, Mesabi.

H. F. Mills, of Metaline Falls, Wash., who is western geologist for American Zinc, Lead & Smelting Co., departed in late summer for Guatemala to do exploratory work for his company.

The resignation of **Dr. Wilburn C. Schroeder** as assistant director for programming of the Bureau of Mines was recently announced by **Secretary McKay.** Dr. Schroeder will teach chemistry and chemical engineering at the University of Maryland, under a contract permitting him also to engage in private consulting practice.

C. H. McCollam, general manager of sales, steel and tube division of the Timken Roller Bearing Co., has announced the promotion of **Harry B. Lilley** as manager of the steel and tube district office in Detroit. **John J. McGrann** was promoted to sales engineer to the manager of the Houston, Tex., office, replacing Mr. Lilley, who in turn fills the vacancy caused by the resigation of **L. W. Eppler.** Mr. Eppler will start his own automotive parts company.

In another move announced by Mr. McCollam, **R. R. Hershey** is being transferred from Timken's Milwaukee office to Detroit. He is succeeded in Milwaukee by **M. A. Conley,** sales engineer at the Cleveland office.

John W. Lampert is now with the Aluminum Company of America's Rosiclare works at Rosiclare, Ill., where he is serving as a mining engineer.

Harry J. Wolf, mining and consulting engineer, of New York, is in South America, where he is engaged in the examination of mineral deposits. After several more weeks at his present location, he will have occasion to make investigations in Argentina, Chile and Peru before returning to the U. S.

DONALD W. HAYWORTH has been named manager of the Edmonton branch and Western Sales representative for Canadian Aero Service, Ltd. and Spartan Air Services, Ltd., of Ottawa, the affiliate companies have announced. Mr. Hayworth's offices will be in Hangar 9, Edmonton. He will represent the two companies in connection with aerial surveys and flight operations now in progress in the Prairie Provinces and British Columbia.

W. T. HUDSON, vice president of Utex Exploration Co., which operates Mi Vida uranium mine near Moab, Utah, located by Charles Steen, is shown checking a drill core. Mr. Hudson, who is also president of Little Beaver Co., which owns claims near the Mi Vida, was one of Mr. Steen's backers.

Changes in the Michigan operations of Cleveland-Cliffs Iron Co. have been announced by president **Walter A. Sterling. James S. Westwater,** former district superintendent, has become general superintendent and **Grant T. Hollett,** district engineer, becomes chief mining engineer of the operations.

William Wright, superintendent of Oliver Iron Mining Division's Rouchleau mine, has retired after 47 years service to the company.

R. J. McCrary is serving as metallurgist and mill superintendent with the United States Tin Corp. at Lost River, Alaska, where the firm operates a concentrator for the treatment of Seward peninsula tin ores.

William B. Johnson of Nuclear Instrument and Chemical Corp. of Chicago and president of W. B. Johnson and Associates of New York, has been elected a director of Salmo Prince Mining Co. of Vancouver. Mr. Johnson was for several years associated with the Atomic Energy Commission at Oak Ridge.

Now located at Ishpeming, Mich., with the Humboldt Mine is **J. A. Poll,** superintendent. The mine is operated by the Cleveland-Cliffs Iron Co. for the Humboldt Mining Co.

Louis Avery has joined the staff of Calera Mining Co. at Cobalt, Idaho.

Mill superintendent **William J. Murphy,** formerly of Marcus, William and the Coeur d'Alene district in Idaho, has joined the Calvin Mining Co., which is leasing the Silver Shield mill at Ouray, Colo.

August F. Rambosek has joined

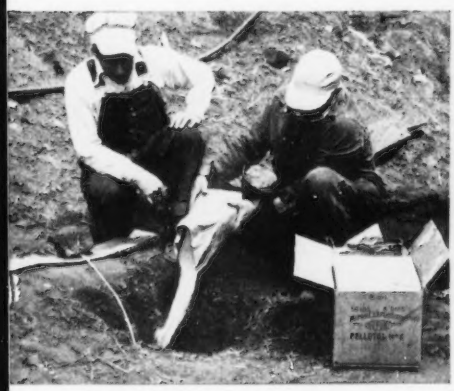
(Continued on page 128)

How Du Pont Blasting "Team" speeds hard-shooting iron-ore operation

Typical strip pit in Northern Minnesota. With high-grade ore becoming scarcer, Taconite is increasing in importance as a valuable source of iron ore. Hard to shoot, it requires top-grade blasting materials.

Loading holes with "Nitramex"® No. 2. Possessing maximum strength and safety, this blasting agent cannot be detonated by ordinary blasting caps, fire, friction or sudden shocks. It contains no headache-producing nitroglycerin.

Lowering "Nitramon" Primer. Relatively insensitive, this primer will detonate every charge as planned. Both "Nitramex" and "Nitramon" are packed in waterproof cans and may be loaded far in advance of shooting.



Giving extra strength to blast. For maximum strength at bottom of wet or dry holes, Du Pont "Pelletol," a free-running blasting agent, is poured in around the main charge. "Pelletol" sifts to bottom, delivers additional energy.

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Excellent breakage from blast permits easy removal by shovel . . . speeds production of ore. That is why these Du Pont blasting products, working as a team, contribute substantially to the safe and efficient operation of strip pits.

ASK THE Du Pont Explosives representative in your area for complete information about Du Pont Explosives, blasting supplies and accessories. He will welcome the opportunity to be of help to you. E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Delaware.

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Personal News *(Continued)*

the White Pine Copper Co., at White Pine, Mich., as a staff engineer.

A. D. Chisholm, general manager for Pickands Mather & Co., has announced several promotions in that organization, effective September 1, 1953: **A. L. Johnson,** former superintendent at the Cary mine, to the Duluth office as operating assistant; **John C. Wangaard,** graduate of Minnesota School of Mines, to the post vacated by Mr. Johnson; **Bruce E. Kennedy,** district engineer on the Gogebic range, to the engineering dept. office at Duluth; and **John L. Sharrer,** engineering department, to Mr. Kennedy's post of district mining engineer.

OBITUARIES

Prof. Kenneth Hume Donaldson, 64, head of the department of metallurgical engineering at Case Institute of Technology since 1937, passed away at his home September 3. Prof. Donaldson graduated from the Columbia University School of Mines in 1912 and worked as a miner, laboratory sampler, foreman, general foreman and testing engineer. He was the author of several reports on foreign markets and conditions and received nation-wide notice with his report on Russia's trade potential in 1933. He was beloved in teaching circles for his deep interest in undergraduate students and was held in great esteem by all his friends and associates.

Bradford C. Colcord, 56, president of Woodward Iron Co. from 1948 until his resignation earlier this year, died Aug. 16 in a Boston hospital where he had been receiving treatment since last April. He was a board member of the National Association of Manufacturers and widely known in the mining and steel industries.

William B. Milliken, retired mining engineer in the Cripple Creek district, died August 25 at a Denver hospital after a long illness. He graduated from the Colorado School of Mines in 1893, and became general manager of the Arequa Mill at Cripple Creek and then general manager of the Union Gold and Extraction Co. of Florence. He was a consulting engineer and operated mining properties in Nevada and Nicaragua, Central America.

Dr. Frederick E. Wright, 75, of Washington, died August 25 at his summer home in the Thousand Islands. He was secretary of the National Academy of Sciences and staff petrologist, from 1906 until his retirement in 1944, of the geophysical laboratory of the Carnegie Institution of Washington.

Marshall D. Draper, internationally known mining and metallurgical engineer, died August 14 at Beverly Hills, Calif., following an operation. Mr. Draper spent many years in China, Burma and the Malay states and, for the past 40 years, had been active in examination and management of mines in the western states, Mexico, Central America and Canada.

John Sims, 64, general manager of the Spokane (Wash.) Mining Syndicate, died Aug. 28 in Grand Forks, B. C.

Charlie S. T. Farish, 65, general superintendent of mines for Cerro de Pasco Copper Corp. in South America before his retirement in 1951, was injured fatally Aug. 29 in an auto accident while en route from El Paso, Tex., to his Albuquerque, N. M., home.

Dr. T. A. Rickard, 89, one of the world's best known mining engineers, passed away August 17 at his home in Victoria, B. C., where he had lived since his retirement some 20 years ago. He was, at various times, state geologist for Colorado, a lecturer on mining geology at Harvard, and editor of the Scientific and Mining Press of San Francisco and the Mining Magazine of London. He was the author of a number of books on mining and history and had completed "Historical Backgrounds of British Columbia" just prior to his death.

The passing of **Robert Allen** on July 2 at the age 87 ended a life of extraordinary variety and interest. A metallurgical engineer for the greater part of his life, he could recall the early days of gold-mining in Australia and on the Rand, and the silver of Mexico. He practiced mining and metallurgy on five continents after taking a B.Sc. at London University.

After retiring, Allen took up responsible work at the Imperial Institute, South Kensington, where he remained for 15 years, part of this time he was in charge of the Mineral Resources Bureau, and he was the author of numerous monographs on mineral resources of the British Empire; he was twice recalled after retiring and in the last war also did special work in chemical research at several wartime factories, only finally retiring at the age of 79.

A man of great integrity, Robert Allen was also extremely versatile; he was no mean linguist having, apart from the Classics, what he called a "working knowledge" of French, German, Spanish and Kaffir. He knew much about music and art; his interests were legion and he was master of several crafts.

Funeral services were held Sept. 18 for **Lewis Webster Wickes,** 74, treasurer and a director of Cyprus Mines Corp., who died at his home in Los Angeles, Calif., Sept. 16. Mr. Wickes was active in the field in this country and abroad and was a veteran of World War I. His passing is mourned by a host of friends and associates throughout the industry.

APPRECIATION

Ralph Emil Gruber, who pioneered placer dredging in the West, died Jan. 29 in Lisbon, Portugal, where he was serving as managing director of the Portuguese American Tin Co. A member of the AIME, he had been actively associated with the placer dredging industry since 1905.

Mr. Gruber was actively engaged in furthering the interests of his company at the time of his death which came suddenly at the end of a long and useful career. His many friends in the dredging and other mining fields were stunned at word of his sudden death. But knowing him as they did, they realized that Ralph would have wished to go in that manner. His good sense of business relationships, tempered by good humor and thoughtfulness for others, made him a natural leader in his chosen field. He will be missed by his associates and many friends who extend to his family their deepest sympathies.

CHARLES M. RAMNOWITZ
Yuba Manufacturing Co.

On Saturday, August 1, 1953, Robert Waskey died suddenly of coronary thrombosis at the age of 46 at his home in Washington, D. C. Since graduation from the University of Washington in 1930, Mr. Waskey's activities as a mining engineer took him to many lands, from Alaska and the continental United States to Latin America and Africa, where he always made a host of friends. Two years ago he contributed his technical experience to the government for the duration of the emergency, as he had done during World War II.

At the time of his death he was employed in the domestic expansion division of the government's mineral procurement organization, DMPA.

The mineral industry has lost a dependable, steadfast engineer with the death of Bob Waskey.

ALAN PROBERT
Assistant Regional Director,
Region IX, U. S. Dept of Interior
Bureau of Mines
Washington, D. C.

Kenneth C. Browne, mining engineer of wide experience and acquaintance, died suddenly on July 10 in a Lakeland (Fla.) hospital. At the time of his death, he was chief engineer of the Florida department of Virginia-Carolina Chemical Corporation's phosphate mining division.

His sudden passing was a shock to the many friends and associates who had come to know him as a fine and highly capable engineer, a cheerful and unselfishly helpful friend, and tireless co-worker. He is survived by his wife.

C. V. O. HUGHES
Assistant Dept. Manager
Virginia-Carolina Chemical Corp.,
Nichols, Fla.

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haul bigger payloads "Boiling-action" loading of Bucyrus-Erie scrapers directs dirt to center of bowl, breaks up chunks to eliminate voids and assures a full and compact load.

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dump fast and clean . . . because positive rolling ejection requires less power and lets you dump in higher tractor gear for quicker action on spot dumps or spreading. Apron is adjustable to secure best dumping of any material.

more working time . . . because the Big Red Team needs less service and maintenance. Lube points are easy to see, easy to get at . . . sealed wheel bearings extend greasing intervals to 500 hours . . . cable lasts longer — doesn't require frequent replacement.

BUCYRUS-ERIE COMPANY
South Milwaukee, Wis.

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BUCYRUS ERIE

Find out more about these B-type Bucyrus-Erie scrapers . . . . . .

MODEL	CAPACITY STRUCK	CAPACITY HEAPED
B-250	22 cu. yd.	27½ cu. yd.
B-170A	16 cu. yd.	21 cu. yd.
B-113	10 cu. yd.	14 cu. yd.

See Your INTERNATIONAL Industrial Tractor Distributor

Hope on Tax Cuts, Gloom on Markets, Progress on Methods, Mark AMC Meeting

"WHAT IT COMES DOWN TO," said Andrew Fletcher, president of St. Joseph Lead Co. and vice-president of the American Mining Congress, "is whether or not you want a lead-zinc mining industry in the United States." A complete shutdown of the domestic industry, he felt, might perhaps be a matter of months, not years.

This feeling, product of falling markets for metals and closure of a number of base metal properties in the West, ran throughout the gathering of the Western Division of the American Mining Congress in Seattle, Sept. 21 to 24. Seasoned observers noted that mining men never seem to find a happy medium except on the way past it. They are either depressed by falling markets, as at present, or worked to exhaustion trying to satisfy abnormal demands for metals.

Despite this apprehension over the near-term outlook, considerable optimism developed in the technical sessions and, for example, in a session on taxation, where the audience was assured by three members of Congress that the House Ways and Means Committee would have the special problems of the mining industry very much in mind in writing new tax legislation.

Tariff Talks Are Lively

Zinc's present situation, with U. S. mines buried under mounting imports of metal, added fuel to a lively discussion of tariff policy in another session. The case for tariffs, and the sliding-scale import tax in particular, was outlined by Fletcher, Rep. Richard M. Simpson, author of the sliding-scale tax legislation, by Joseph H. Taylor of Peru Mining Co., and W. L. Long, Tungsten Mining Corp. Dr. G. C. Monture, of the Canadian Department of Mines and Technical Surveys, Jean Vuillequez, of the American Metal Co., and J. A. Costello, of the Ethyl Corp., spoke for lowered trade barriers.

In response to Fletcher's plea for protection of U. S. miners, Dr. Monture pointed out that barriers to trade with the U. S. might lead to Canadian retaliation in the form of an export tax on nickel and asbestos. Fletcher called attention to the high Canadian tax on imported zinc oxide. Vuillequez suggested that the position of U. S. zinc miners might be greatly improved by studies of new markets for zinc. He thought more attention should be paid to the inroads of plastics and aluminum on zinc's markets.

In opening the convention, Arthur S. Flemming, director of the Office of Defense Mobilization, sobered the group by stating that the U. S. must prepare to meet "devastating attack" at any time. Never again will we have the time we had after the start of World War II to mobilize," he said. He went on to outline the various measures his department is taking to keep the country in a state of readiness to beat off an attack that may come at any time and to retaliate effectively.

Felix E. Wormser, assistant Secretary of Interior, spoke against international trade barriers and restrictive trade agreements. He said that he had been surprised to find that no one agency in Washington has the responsibility of formulating a sound national minerals policy. He outlined several areas in which such a policy ought to be developed.

Roger H. McConnel, chief geologist for Bunker Hill, in a session on public lands policy, spoke for most mining men in saying that although the present mining laws needed some correction, care must be taken not to destroy the incentive to prospect. He felt that better enforcement would be of great help.

Other speakers outlined corrective measures that might be applied. Some were outspoken in condemning the U. S. Forest Service for misleading the public on the nature of filing mining claims. Rep. John P. Saylor, of Pennsylvania, aroused the audience by saying that the mining industry had "the poorest public relations" of any major U. S. industry. He likened mining's attitude on public land policy to the head-in-sand tactics of the ostrich.

Lewis E. Hoffman, chief of the division of minerals, Bureau of Land Management, said his agency wanted to cooperate with mining men in the administration of the land laws. Sen. George W. Malone, Nevada, said he and Sen. Henry C. Dworshak, of Idaho, would go right on beating down every attempt to get through Congress any bill involving leasing of mineral lands, as opposed to the present system.

Calling attention to the fact that the Eisenhower Administration, during its first eight months had failed to clarify its position on Taft-Hartley law revision, Charles R. Kuzell and Denison Kitchel analyzed attempts at rewording the Taft-Hartley law and suggested possibilities. They favored prohibition of compulsory unionism, outlawing of industry-wide bargaining, action against Communist unionism, and other changes strengthening the law. They felt that unless the pro-Taft-Hartley forces do not "launch an offensive immediately," those who favor weakening the law may gain their way.

In giving a background of domestic uranium production, Blair Burwell stated that the Colorado Plateau today is a scene of bustling vigor, of optimism and vast expansion of resources. Its inventory of accomplishment is impressive with mine plants either building or operating. Some 60,000 sq. mi. of canyon country are being probed with several millions of feet of drill holes per year. New communities, new roads and dusty truck trains mark the transition of a frontier into a modern industrial community.

Uranium Metallurgy Reviewed

S. J. Swainson told of the research work in progress on gravity, attrition and flotation concentration methods to beneficiate domestic ores of uranium. However, at the present time, they are better treated by hydrometallurgical methods. In general, there are two main and different lixiviants used for leaching domestic ores. (1) hot (90° C) 5 to 10% solutions of sodium carbonate, and (2) dilute sulphuric acid. Type of ore usually determines which process is to be used. All plants, whether acid or carbonate, use standard milling equipment, and, except for the necessary acid proofing in the former, are very similar to cyanide plants.

Sheldon P. Wimpfen said that despite difficulties attendant to uranium mining, such as the sporadic nature of many ore depositions and remote physical locations, a survey of operations of a representative segment of the ore producers indicated that uranium mining is profitable. Costs ranged from $8 to $28, and profits from $5 to $29 per ton. As a further indication that this is so, ore production currently exceeds milling capacity. Base price per lb. for contained uranium ranges from $1.50 for 0.10% U_3O_8 ore to $3.50 for 0.20% U_3O_8 ore. Premiums of $0.75 or $1 per lb. are paid for ores of richer than 0.20% U_3O_8 grade and V_2O_5 content is paid for at $0.31 per lb. An additional development allowance of $0.50 per lb. is applicable to all contained U_3O_8. To encourage development and defray a portion of initial costs of opening a mine, a bonus, over and above the ore purchase price schedule is paid on the first 10,000 lbs. of contained U_3O_8 from new discoveries. The bonus is on a sliding scale depending on the

(Continued on page 132)

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What Made AMC Seattle Meeting Interesting

(In part, that is.)

Getting up at 4:30 a.m. in the rain to get out on Puget Sound for the Salmon Derby. We hear the winning fish weighed 7 oz., but we don't believe it. Would the real winner let us know, please?

The debate on free trade vs. tariffs. Both sides made a lot of sense but the convention went for tariffs in the end.

Ellsworth Alvord's "good news tonight" on impending tax benefits.

Bob Sandvig's account of how push-feed drills are tested at Butte and what they can do. A. A. Campbell and R. W. VanEvera did an equally good job for Calumet & Hecla. (See text.)

Seattle's promise to supply fair weather. The next day it rained.

The Mermaid Cruise. (No men allowed.) Wonder what happened?

Uranium mining is profitable, said Sheldon Wimpfen, AEC's manager at Grand Junction. Profits in the Plateau range from $5 to $29 per ton.

Congressman Saylor's blast at mining's public relations efforts on the mineral land laws. He says they couldn't be worse.

The opportunity, except for a jam-packed Wednesday afternoon, to get to nearly every session you wanted to hear. No "six simultaneous sessions" planning, thank goodness!

richness of the ore, with $35,000 being the maximum amount payable.

In discussing tax problems relating to uranium mining, Wm. F. Tilton, Jr., stated that present Federal tax laws can have the effect of deterring rather than stimulating exploration for and full production of uranium.

New Mining Techniques

J. B. Knaebel in an informal talk supplemented by slides described the uranium operations of Anaconda Copper Mining Co. at Grants, N. M.

In the technical sessions, scrapers highlighted the trends toward larger capacity and simpler-to-operate equipment, both in open pit and under ground.

L. M. Kinney, describing trackless mining at Pend Oreille Mines, said that substitution of this method for scraper mining increased the average tonnage per man-shift from 8 tons to 25. The new method uses Rogers or Caterpillar jumbos mounting Joy drill jibs; Eimco loaders and Dart 6-yd. trucks.

A. B. Chafetz and E. C. Skinner described new developments at Carlsbad, where increased demand for potash has led to use of continuous miners, jumbo drills, diesel-electric locomotives underground, conveyor or belt systems, and other means of increasing output.

Trolley telephones and other improvements have speeded up haulage at Climax, according to John Petty, mine superintendent. Large folding scrapers and 150-hp tandem hoists handle rock faster than formerly. Production at Climax is up to 28,000 tons daily.

Major changes made at the Copper Mountain Mine in southern British Columbia recently include the adoption of air-leg drills and integral tungsten-carbide tipped steel for all development work. Air trammers: 3-ton cars dumped by air cylinders connected to the trammer (*E&MJ.*, August, 1953, issue); and replacement of blast hole diamond drilling in favor of percussion drilling with 3½-in. or 4-in. drifters, using jointed steel and tungsten-carbide bits, resulting in a drop of drilling costs from $1.07 per ft. to $0.55. Also, the larger holes (2⅛-in. compared with 1⅝-in.) drilled with drifters allow greater burden, and 4.23 tons per ft. of hole are broken compared with 2.77 tons when using diamond-drill holes. Depth of holes varies from 60 to 100 ft., but they have been drilled as deep as 140 ft. Investigating the possible use of waste rock from development headings for concreting the scraper drifts showed that this material made cheaper, better, concrete aggregate than the gravel hauled several miles to the mine, and the design of an underground aggregate plant is being considered.

In his review of new non-ferrous mining projects and new mining and milling techniques and equipment, R. H. Ramsey, Editor, *E&MJ*, pointed out that in the U. S. alone, actual or planned investment in new mining projects now reaches $1,253,500,000.

Steel Sets in Tunnels

W. R. Doyle discussed the use of steel rail sets in the Yak tunnel 19,000 ft. long and originally containing 2,000 timber sets. Average life of the timber sets, due to ventilation and acid water, varies from 4 to 6 yrs., and maintenance was high. The company evolved a two-piece arched set made from used steel rails, and to date has installed about 800 of them in the tunnel. The steel sets cost less in place than wood sets.

R. W. Whitney's paper on new developments in iron ore mining was read by E. S. Mollard, both of M. A. Hanna Co. Mr. Whitney forecast a need for 145-million tons of iron ore by 1970. This increased consumption will be met from taconite beneficiation and by greater imports of high grade ores. Potential investment in taconite projects now totals more than $500 million, Mr. Whitney said.

In another operating session, R. L. Sandvig, Anaconda Copper Mining Co., described how air-leg drills are tested competitively for use in Butte. He listed operating advantages of the air-leg drill as: reduced operator fatigue, elimination of auxiliary equipment, less time spent in drilling, less drill steel required, greater output per man shift.

C. A. Campbell and R. W. VanEvera said that at Calumet & Hecla, use of air-leg drills raised ft. of hole drilled per miner-shift by 45% and doubled the tonnage per man shift. There were other benefits listed, but they also said that few of them were realized until the miners had been trained by experts in the use of the air-leg drill. Negligible gage loss on tungsten carbide bits saves money by permitting smaller holes.

In discussing mining methods in the State of Washington, E. G. Easterly, Atlas Powder Co., mentioned that long-hole drilling with 4-in. stopers and 2-in. carbide bits had been done at one-third the cost per ft. of hole of the diamond drilling method formerly used.

J. A. Lentz, Jr., mine superintendent at Ajo, Ariz., said that he has found large churn drills, swinging 6,000-lb. tools in 11¼-in. holes, most effective for drilling in rhyolite or monzonite. Heavy percussion drills with 6-in. tungsten carbide bits do better in Ajo's tough, hard "fan-glomerate", where these drills put out 144 ft. of hole per shift.

The Resolutions

Resolutions adopted by the convention called, among other things, for the following:

A constructive Federal Government Mineral Policy; continuance of the Silver Purchase Act; restoration of the gold standard; free ownership and convertibility of gold; a flexible tariff to protect domestic mines against dumping of foreign metals; permanent stockpiling of strategic and critical materials; balancing of the Federal Budget; strengthening, not weakening, of the Taft-Hartley law; provision of certain tax benefits for mining, including tax exemption for the first three years of production of a new operation; and a study by Congress of the SEC regulations.

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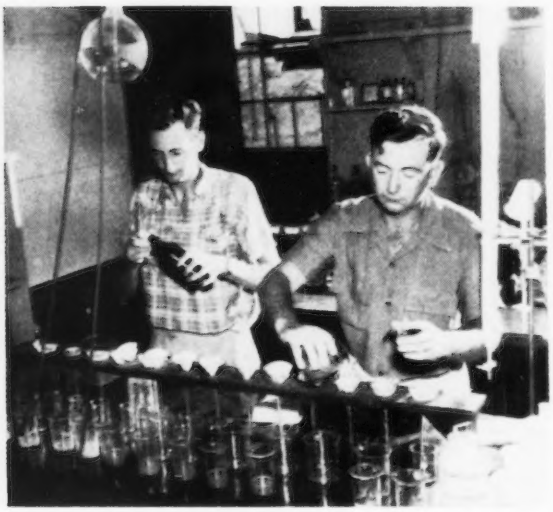
IN THE FIELD, Elliott, left, and Debnam collect a sample of earth from an area 30 miles from Australia's Mount Isa.



IN THE LABORATORY, Debnam and Elliott chemically test samples of earth obtained in the field the previous day.

Diphenylthiocarbazone Australians Are Using It to Find Ore

IN AUSTRALIA, prospectors are searching out the nation's mineral wealth with test tubes!

The government is speeding up a bold new plan to map the Continent's mining potential and has used geochemistry as a spur.

Teams of geo-chemists are sent into the bush with two goals in mind: the short-range aim is to pinpoint deposits in areas which may be developed in the near future; the long-range aim is to explore chemically every part of Australia which has not been tested thoroughly by other means.

The relatively new method of prospecting was introduced into Australia in 1948-49 by Dr. V. P. Sokoloff, of the U. S. Geological Survey. Dr. Sokoloff toured a section of eastern Australia and demonstrated the procedure to Australian scientists.

One of the scientists who accompanied Dr. Sokoloff into eastern Australia, Adrian Debnam, is now busy putting the method into practice. Debnam and an assistant, Bill Elliott, both of Australia's Bureau of Mineral Resources, teamed up to experiment in a mining area at Mount Isa, in northwestern Queensland.

Debnam and Elliott decided that the best way to do the job was to work in the field one day and in the laboratory the next. That way, all samples collected during a field day could be tested and classified almost concurrently.

The area selected by Debnam and Elliott was about 20 mi. from Mount Isa, in hot, arid spinifex-studded bush. Three generations of prospectors had passed through this area without finding enough promise to warrant establishment of a mine.

Geo-chemical samples usually are collected from selected areas on a grid system. Debnam chose a peg as his center mark and with tape and compass measured out a 100-ft. grid in all directions. His grid system measured between 2,000 and 3,000 ft. in length and 800 ft. in width.

To collect samples, holes were dug at each intersecting point of the grid. Depth of the holes varied from ½ to 18 in. About a half-pound of soil was placed in a bag labeled with the bearing of the hole.

The following day, Debnam and Elliott, handling each bag separately and carefully, diluted samples with a small weighed quantity of acid. Each sample then was filtered and the filtrate was tested with an organic reagent called diphenylthiocarbazone, which indicates presence of copper, lead or zinc.

At Mount Isa, Debnam's work was for the government primarily but all information was given also to Mt. Isa Mines. The results obtained were not accurate quantitatively because it was necessary to know only relative amounts. The relative assay of each sample was marked on a large-scale map. Where results showed worth, the next step was to core-drill the area up to 2,000 feet.

In one area, Mt. Isa Mines thought it had a good lead prospect. Geo-chemical tests revealed that there was no lead but that there was promise of a valuable copper deposit. In other parts of the company's property, two new lead deposits were located. Two other lead prospects, believed to harbor wealth, were shown to be unprofitable for mining.

Mining fever is running high in the Down Under Continent. Just about every type of prospector known to mankind is now roaming northern parts of Queensland, Western Australia and Northern Territory. There is the sandgroper who chases gold with his pan and pick; the copper gouger who taps for the mineral with sledge hammer and steel drill; the uranium seeker who explores the brush with a Geiger counter; the government expert who prospects for uranium in an airplane; the geologist, mineralogist and the geo-physicist. And now the chemist has joined the ranks.

IN MINING

International Nickel Plans $16-Million Plant To Produce By-Product Iron from Nickel Ores

INTERNATIONAL NICKEL COMPANY of Canada Ltd. has announced plans for a $16-million plant to produce by-product iron from nickel ores.

Construction of the plant is to begin immediately. It is to be located near Copper Cliff in the Sudbury District of Ontario, where the firm's mining operations are centered.

The plant will be the first unit in an operation which ultimately will yield about 1-million tons of high-grade iron ore yearly, in addition to nickel from Sudbury ores.

J. Roy Gordon, vice president and general manager of Canadian operations credited Inco's research staffs with the historic iron ore-from-nickel ore development.

Iron ore from the new plant reportedly will contain at least 65% iron natural and less than 2% silica. Initially, the plant will treat 1,000 tons daily of nickel-bearing pyrrhotite removed from ore in the early stages of processing at Copper Cliff.

In addition, the new process, with its yield of iron ore, now makes possible the treatment of lower-grade Sudbury ores hitherto considered uneconomical.

The new trail-blazing process, in addition to being the first to permit recovery of high-grade iron ores, is of great importance in opening the way for increased recovery of other elements, including sulphur when its production is economically feasible, from the complete Sudbury ores, Gordon added.

Tungsten, Graphite Institutes Formed

FORMATION of The Tungsten Institute with headquarters in Washington has been announced by W. Lunsford Long, of Warrenton, N. C., president of the new organization.

In addition to Long, who is vice president and general counsel of Tungsten Mining Corp., Institute officers include Charles H. Segerstrom, Jr., president, Nevada-Massachusetts Co., vice president, and James A. White, executive secretary-treasurer, who heads the Washington office at 1745 K St., N. W.

Meanwhile, it was announced from another quarter that the Graphite Institute of America has been chartered "for the purpose of safeguarding the quality interests of the consumer." J. E. Vesely, of the Inland Graphite & Chemical Co., Chicago, has been named chairman.

New Materials Division Established Under GSA

ESTABLISHMENT OF A Materials Division in the General Services Administration was announced Aug. 28 by Administrator Edmund F. Mansure.

The new Division will take over the procurement responsibilities for metals and minerals formerly handled by the Defense Materials Procurement Agency. The latter was abolished Aug. 15 by Executive Order, and its remaining functions, duties and personnel transferred to GSA.

McKay Names Van Pelt To Head USGS Survey

SECRETARY OF INTERIOR McKay has named J. Robert Van Pelt, president, Montana School of Mines, to head a committee to investigate and analyze the organization and operation of the U. S. Geological Survey. The committee is to report by December 15. Study is to cover operation both in Washington and in the field and relationships with other Federal agencies and local governments.

Van Pelt

Bacteria Salvage Copper From Tailings Waste

ACTION OF MICROBES produces 15-30 tons of almost pure copper from tailings waste daily at Kennecott Copper's Bingham Canyon Mine in Utah, according to Dr. J. V. Beck, of Brigham Young University. Dr. Beck described the microbe's action in a paper given before the Society of American Bacteriologists at an August meeting in San Francisco.

The microbe gets sugar-making energy from copper sulphide by converting the sulphide into sulphate. When this ionization takes place, the copper particles settle to the bottom of iron tanks. For the microbe, the copper is a nuisance.

News Highlights

U. S. Vanadium Mines in California is developing an unusual system of storing excess air. **Page 140.**

University of Hawaii has reported finding rich deposits of titanium oxide. **Page 146.**

American Chrome Co. has begun production of chromium concentrates at its Mouat mine and mill in Stillwater County, Mont. **Page 154.**

Utex Exploration Co. announced that it is considering construction of a $3-million processing plant. **Page 168.**

Hogarth open pit mine on Ontario's Steep Rock Range has been formally opened. **Page 172.**

A major resurgence of mining activity is gathering momentum in New Brunswick. **Page 178.**

Frobisher Ltd. reportedly may spend from $500-million to $2-billion on a power and mineral development in the Yukon. **Page 186.**

CORFO reportedly has decided to build a sulphuric acid plant in Chile's Antofagasta Province. **Page 188.**

Antimony mining in Mexico's Queretaro area reportedly was dealt a near-death blow by the Korean armistice. **Page 190.**

Sullivan Concentrator at Kimberley, B. C., has just begun its 30th year of operation. **Page 196.**

Witwatersrand Gold Mining Co., one of the oldest gold mines in South Africa, is ceasing operations because of high working costs. **Page 198.**

Negotiations for copper and copper ores between a Chilean smelter and a German firm are to begin this month. **Page 202.**

A new type of magnetic separator has been developed in Norway. **Page 204.**

USGS has released a map showing uranium occurences in the United States. **Page 206.**

Western Machinery Co. of San Francisco has announced the licensing of a firm in Japan to manufacture ore dressing mining equipment. **Page 206.**

BIN Stuck Lately?

Mines everywhere have found CLEVELAND **air** vibrators the solution to their arching, bridging and sticking problems.

With a CLEVELAND, materials move through handling devices efficiently and economically, thus cutting down production time and costs.

We have a size and type, either quiet or standard, to fit your requirements.

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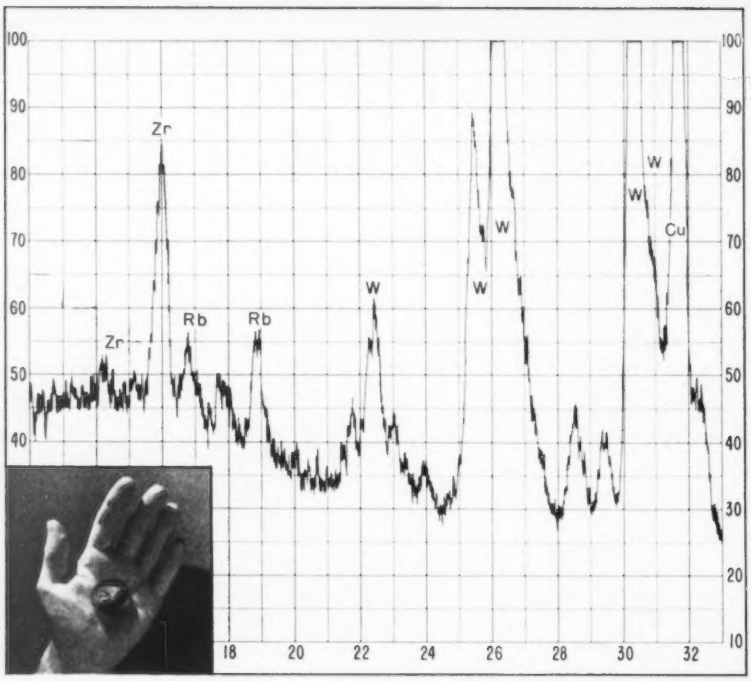


SECTION OF CHART indicates results of spectrograph run on piece of reddish-brown rock picked up in Pennsylvania by an employee of the North American Philips Co. The employee sent the sample to the company's Research & Instrument Control Div., 730 South Fulton Avenue, Mount Vernon, N. Y. Tests run on the rock (about the same size as that shown inset) indicated presence (shown above) of zirconium, rubidium, tungsten, copper and (not shown above) manganese, titanium, nickel and iron. Equipment for running the tests cost $6,000-$16,000. One Utah mine operator who bought the $16,000 equipment, voluntarily wrote in to say that through better assay results, he had recovered his money in 30 days.

Iron Ore Beneficiation Attracts Many to Hibbing Meeting

INTEREST IN THE QUESTION of future iron ore supply, especially that to be had by treating taconite, and the need for keeping abreast of new developments in ore dressing brought a big turnout at the annual fall meeting of the AIME's Mineral Beneficiation Division, held at Hibbing on the Mesabi Aug. 31-Sept. 2. The peak of attendance was well over 700. Group comprised operators, engineers, and manufacturers' representatives from all parts of the U. S., with some from Canada.

The big lure was the chance of visiting U. S. Steel's recently completed half-million-ton taconite pilot plant near Mountain Iron and Reserve Mining Co.'s year-old 300,000-ton plant at Babbitt. Other bait was provided in possible trips to nine other beneficiation plants of varied size and flowsheet east and west on the Mesabi, which had been arranged. While it was physically impossible to visit all these plants in the two days allotted, anyone who managed to see the two big plants and his selection of the others must surely have felt rewarded.

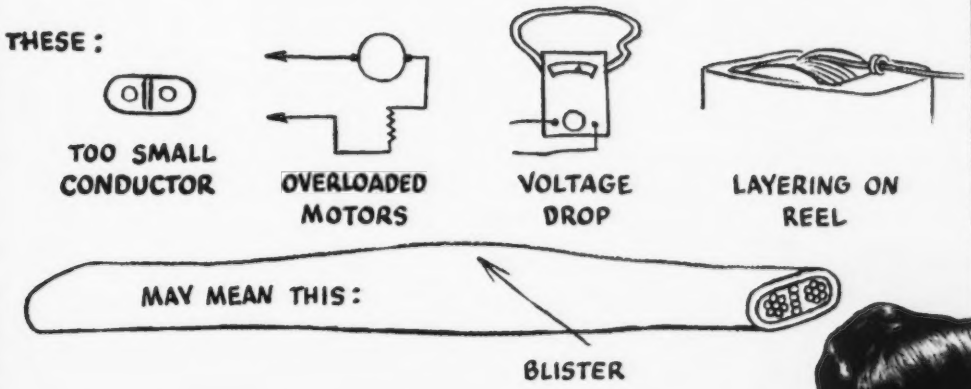
Inspection of the Babbitt plant left no doubt that pellet production for the steel plants is already an actuality. The generalized flowsheet distributed was little different from that published, unnamed, in *E&MJ* for July, 1952, page 73. The economic aspect as to per-ton cost was a matter for speculation only, no data being provided or indeed expected.

Oliver Division's (U. S. Steel) big Pilotac plant proved impressive. Abundant room is provided, both horizontally and overhead, for rearranging or adding equipment. Termination of the treatment on the top floor and the use of bucket elevators excited interest.

Of particular interest among the other plans was the compact concentrator of Coons-Pacific, equipped for treating almost any custom ore from Range mines, and Pickands Mather's West Hill plant, the newest and most modern in the Iron Country.

Technical sessions on the opening day were marked by three papers of

HOW TO SPOT DAMAGE FROM CURRENT OVERLOAD . . .



. . . AND WHY THERE'S GREATER HEAT STAMINA IN ANACONDA'S NEW MINING MACHINE CABLE

Blisters, formed by gases from overheated installation, are a sure sign of cable overloading. A torn cable may result. Since you can't always control overloads, it's important to choose *quality* cable.

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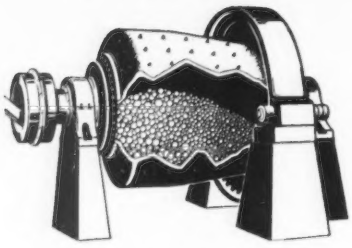
WELDING CABLES

TRICONE MILLS



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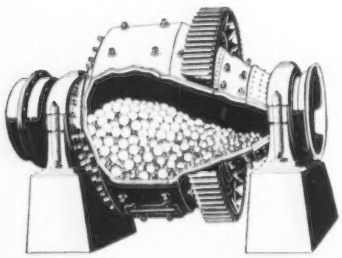
CONICAL MILLS



For fine grinding and pulverizing. Balls or pebbles classify by size, automatically. Bulletin AA-389-1.

HARDINGE

This Month in Mining *(Continued)*

a general nature and two dealing with taconite. The former group comprised discussions of Mesabi geology as it effects beneficiation, by Dr. G. M. Schwartz; of trends in Mesabi mining, by B. M. Andreas; and of beneficiation of Mesabi ores, by H. H. Wade.

The second group included a discussion of the chemical and physical characteristics of taconite which affect concentration, by D. M. Scott, and a paper by R. L. Bennetts on nodulizing ores and concentrates at Oliver's Extaca plant, near Virginia. Up to now this plant has been working on ore fines from nearby mines but, sooner or later, it will also be experimenting with Pilotac concentrates. Earl Herkenhoff's paper on Cyclones, originally presented at last January's Symposium in Duluth, was included in the program.

R. T. Elstad, Oliver's president, in a luncheon speech, called for cooperation in the effort to recover the iron in Minnesota's low-grade ore reserves. The speaker at the annual dinner was L. A. Rossman, publisher, of Grand Rapids, Minn., who recounted earlier attitudes toward the development of Range ore reserves.

DuPont Plans $3-Million Florida Ilmenite Project

A $3-MILLION ILMENITE mine and plant will be constructed for the Du Pont Co. near Lawtey, in north central Florida, the company has announced. Construction is to begin this month. Operation is scheduled for early 1955.

The new plant, to be known as the Highland Plant, will be built and operated for Du Pont by Humphreys Gold Corp., of Denver. Humphreys also will supply some major equipment. Highland Plant is about 17 mi. north of Du Pont's Trail Ridge ilmenite plant near Starke, Fla. As at the Trail Ridge plant, ilmenite will be mined by a floating dredge. The ilmenite will be extracted from lake sands.

A dredge and separators, floating on a lake, pick up sand in front, extract the black ore, then pour the sand back into the lake again behind the dredge. Capacity of the new plant is expected to equal the output of the Trail Ridge plant—about 100,000 tons a year.

'Mining Days' Meet Set Oct. 28-31 In El Paso

MORE THAN 1,000 delegates are expected to attend the 1953 version of International Mining Days in El Paso, October 28-31. Paso Del Norte Hotel is to be headquarters for the convention. Reservation requests should be sent to Ted Lind, El Paso Chamber of Commerce, 310 San Francisco St., El Paso, Texas.

IN THE U.S.

ALABAMA

★**Alabama's new** "right to work" law, which Gov. Gordon Persons signed Aug. 28, is not expected to greatly affect the mining industry. The law itself was not designed to destroy labor unions but to give all workers a free choice in joining or not joining a labor union.

The law protects the worker against loss of job because he is or isn't a member of a union. Further, the law bans the closed and union shop and it makes illegal the mandatory checkoff of union dues.

Mining management has been silent on the law and for the most part the same applies to mine unions. They are fairly well closeknit and have gone through many a battle to organize all workers.

ALASKA

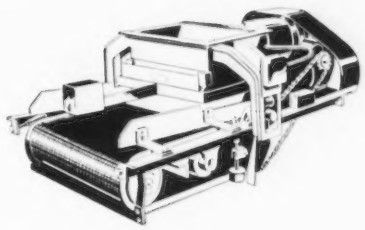
★**Admiralty-Alaska Gold Mining Co.,** with a DMEA loan of $112,000, has extended an exploratory drift 500 ft. into the mountain at Funter Bay, near Juneau, and has confirmed rich ore values previously indicated by surface diamond drilling. The U. S. Bureau of Mines has directed the work and S. H. Lorain of the Bureau went to Funter Bay to examine the nickel-cobalt-copper strike and make recommendations. It is reported that mining experts expect the project may be in large scale production before long.

★**Admiralty-Alaska Gold Mining Co.** of Juneau, is engaged in exploration of a nickel-cobalt-copper deposit at Funter Bay near Juneau on a $112,000 loan from DMEA, under direction of the U. S. Bureau of Mines.

W. S. Pekovich, Box 529, Juneau, has the controlling interest in the company.

★**The following operations** were reported in the Flat District by John Miscovich, Fairbanks mining man who says there has been a serious shortage of water in the area: Alex Mathieson is employing 10 men on his dredge at Flat; Stien and Ogriz are operating a dredge north of Flat; Miscovich Brothers have worked 2 shifts on Discovery Creek this season; Harry Agoff and sons have had encouraging results on Prince Creek using a D-8 caterpillar and bulldozer; Ogriz and Uotiala's operation on Slate Creek had closed and the Awe Mining Co. at Chicken Creek has been dissolved. Equipment from the latter will be taken to Colorado Creek by the Fullerton Bros. and part will go to Gaines Creek to be used by Rosander and Reed. In the Ophir District, which is also reported to be dry, Gus Uotiala is working on Ophir Creek and Toivo Rosander is on Yankee Creek. Rosan-

CONSTANT-WEIGHT FEEDER



A regulating feeder which maintains a positive constant-weight feed rate regardless of feed size or volumetric variation. Bulletin 33-D-1.

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Alaska *(Continued)*

der is also interested in Neil Beaton's operations on Gaines Creek where a couple of cleanups have been reported. Some development work has been done on Spruce Creek by Pat Savage and Joe Degnan is operating on Esperanto Creek.

ARIZONA

★**New discoveries** of ore in the Harshaw and Washington districts near Patagonia in Santa Cruz County raise hopes for revival of near-ghost camps. Malachite and cuprite ores have been reported in claims held by Lee Ferrell and associates 2 mi. west of Harshaw. Sulphide ores have been found in explorations at Washington. Silver in paying quantities also was present. Estimates are that the ore bodies in both mines will average around 10%.

★**Arizona Girl and Little Annie**, lead, silver, and gold properties in the Gold Hill District near Ruby in Santa Cruz County are scheduled to start upon completion of road construction. Machinery and equipment have been moved and 200 ft of tunneling completed, according to J. L. Watts and associates.

★Arizona Corporation Commission has set Oct. 12-13 for public hearings on the railroads' 15% freight rate applications on intrastate hauls. Arizona ore shippers, spearheaded by the Arizona Small Miners Assn. and the Arizona Department of Mineral Resources are expected to protest.

★**Kennecott Copper Corp.** has asked the Arizona Board of Equalization to reduce the $14-million valuation of its Ray properties in Pinal County. The company based its request on heavy stripping costs to open and operate its pit mine plus the need for stepped-up exploration to keep the mine going.

A. B. Morris, general superintendent, said the present ore reserve will keep the mine going only about four more years. He said the underground mine is virtually worked out and operations in it will cease if the price of copper drops sharply.

CALIFORNIA

★**U. S. Vanadium Mines** at its Pine Creek Mine near Bishop, Calif., is developing an unusual system to store excess air produced by compressors for its underground drilling equipment.

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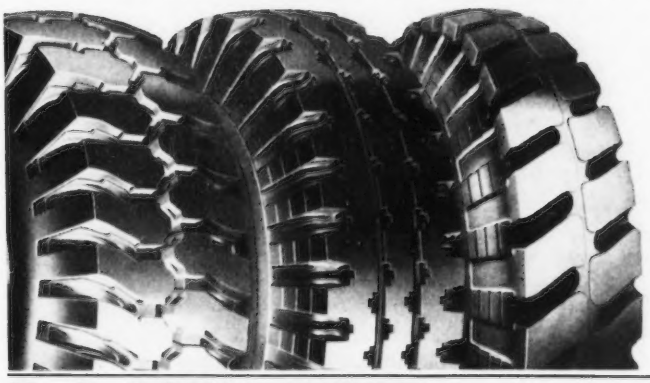

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California *(Continued)*

★**Yuba Consolidated Gold Fields Corp.** has won its attempt to have 2,000 ranchers' suits against the company consolidated. The firm is being sued for damages resulting from 1950 floods on the Yuba River near the site of its dredging operations. The 2,000 suits filed at the time Yuba requested the consolidation amount to $950,000. Subsequent suits boost the total damages requested to between $2 and $3 million. The Ninth U. S. Court of Appeals ordered the consolidation and affirmed Federal Judge Dal Lemmon's jurisdiction. Earlier, the Sacramento judge (Lemmon) ruled that he did not have jurisdiction.

COLORADO

★**Vanadium Corporation of America** has obtained approval of the Atomic Energy Commission to install at its Naturita, Colo., mill a roaster for processing vanadium-uranium ores mined from its own properties and purchased from many independent producers. This and auxiliary facilities now being built should be in production in the fourth quarter. The company also has exercised its option to purchase the mill at Durango, Colo., which also processes vanadium uranium ores.

★**Diamond drilling** has been ended and plans are being drawn for a mill at the Colorado fluorspar property of Seymour Mining Corp. of Vancouver, B. C. Operations now will be concentrated on underground development and mill construction. Diamond drilling indicates reserves of more than 1,000,000 tons grading $12 per ton, sufficient to supply a 1,000-ton mill for three years, according to company officials.

★**Eagle Mine** at Gilman, of the Empire Zinc Division, New Jersey Zinc Co., ceased production Aug. 31 when 350 employees went on strike. International Union of Mine, Mill & Smelter Workers and its local union, Battle Mountain Miners Union No. 581, reportedly had asked for a 15c hourly increase and "fringe" benefits. The company replied that "it did not feel justified in increasing its costs at this time in view of the poor condition of the zinc business." At press time, only a maintenance crew was retained at the mine.

★**Leadville Lead Corp.** officials are studying possible uranium operations in the Colorado Plateau area. The firm's extension of the Dauntless tunnel in company lead-zinc properties near Leadville has been completed and diamond drilling for orebodies is now under way.

★**Sprague & Henwood, Inc.** of Scranton, Pa., recently was awarded several large contracts for diamond core drilling exploration for uranium ore in the Colorado Plateau area. The

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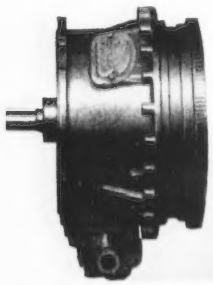

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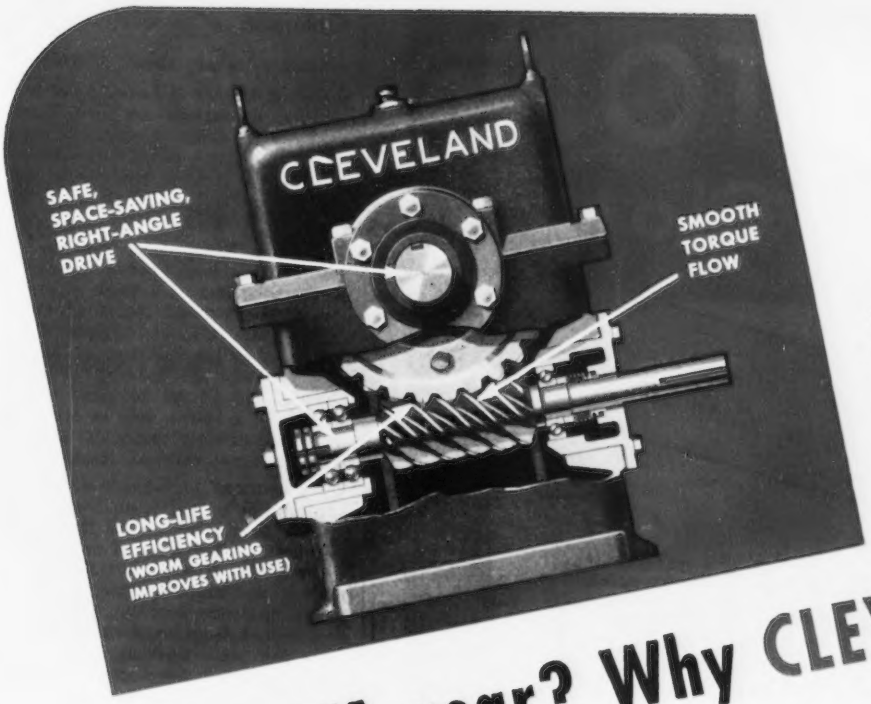

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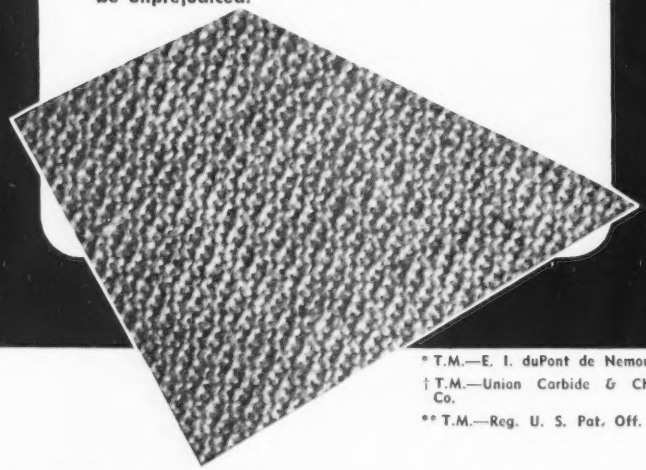

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Colorado *(Continued)*

contracts total about 270,000 ft.

★**United Mining & Leasing Co.** is resuming operations on the Eureka group of claims in Gilpin County, which they have under lease, extending the 175 ft. level toward the main Eureka shaft. V. R. McKay of Central City is manager.

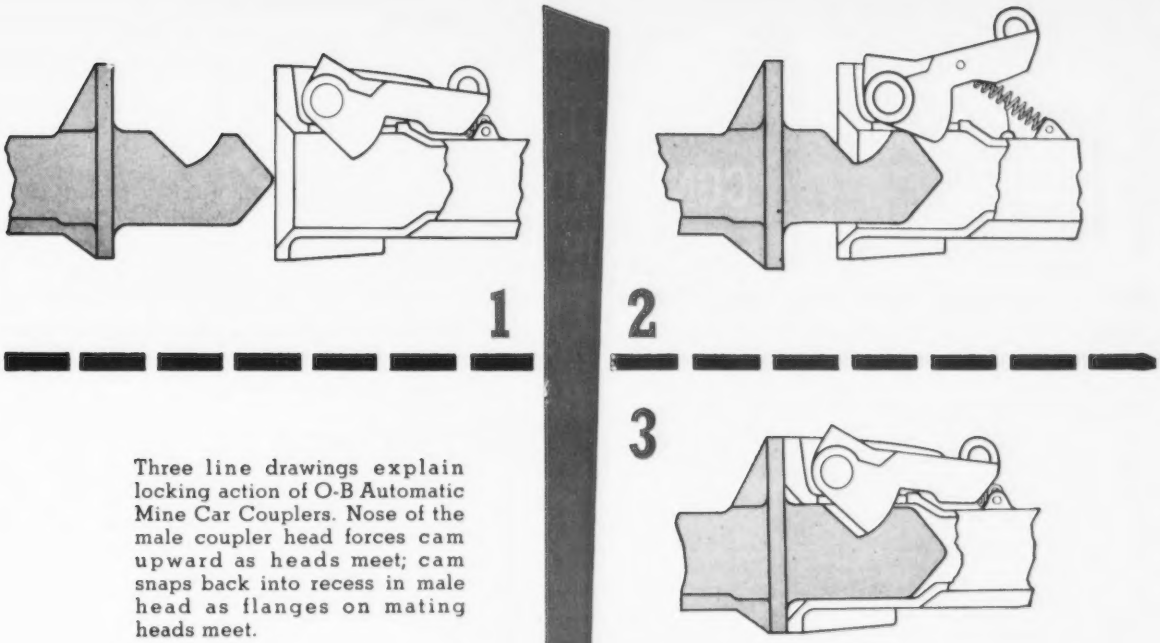
★**Isabella Mines Inc.,** inactive for some time, has opened operations again, this time on a block of ground leased on Portland No. 1 of United Gold Mines Co. at Cripple Creek. President William Kyner of Isabella reports they are moving in power shovels and trucks to clear off the surface of a known vein of ore which is located directly under the old Midland Terminal railroad tracks.

★**Discovery of** high-grade manganese ore on the property of the Juaneta Mining & Milling Co. at Montezuma is reported. The body of ore was discovered by Ralph Terrell, who is leasing the property from the company. Quite by accident, the top soil was moved from an area up the hill from the main workings and it was discovered that there was manganese ore for a depth of more than four feet over a large area.

★**Rich Galena Gulch** near Breckenridge is being placered again for gold. Harry Nilene and Eddie Cass from Leadville are working with Claude Roberts, owner of placer property. Nilene has heavy machinery that will be used in washing and moving the gravels. Roberts in panning some gravel found, in the single pan, a nugget and many colors. The ground is reported to average more than $3 per yard.

★**An increase** in the filing of mineral rights' leases in Huerfano County with guarded reports of uranium discoveries in the La Veta area is reported. The K. S. Mittry Construction Co. of California, which has been conducting explorations in the area, indicated it was ready to move in to begin mining operations in the near future.

★**Cripple Creek** is buzzing with excitement as word has spread that two "Aladdin's caves of gold" have been discovered on the 31st or bottom 3100 foot level of the Ajax Mine on Battle Mountain. Not since 1914 when the famed $1,200,000 vug was found on the 12th level of the Cresson mine, has ore of such Croesus-like richness been reported. A few officials of the Golden Cycle Corp., owner of the mine, estimate the better ore may be worth as much as $40 to $50 a pound. The two underground vaults were blasted into recently. The walls of the highly mineralized caves glistened with sylvanite and calverite. "It is a sight a mining man may see but once in a lifetime if he's lucky," was the feeling expressed by M. H. Grice, superintendent of the mine, when he first viewed the bonanza.



Three line drawings explain locking action of O-B Automatic Mine Car Couplers. Nose of the male coupler head forces cam upward as heads meet; cam snaps back into recess in male head as flanges on mating heads meet.

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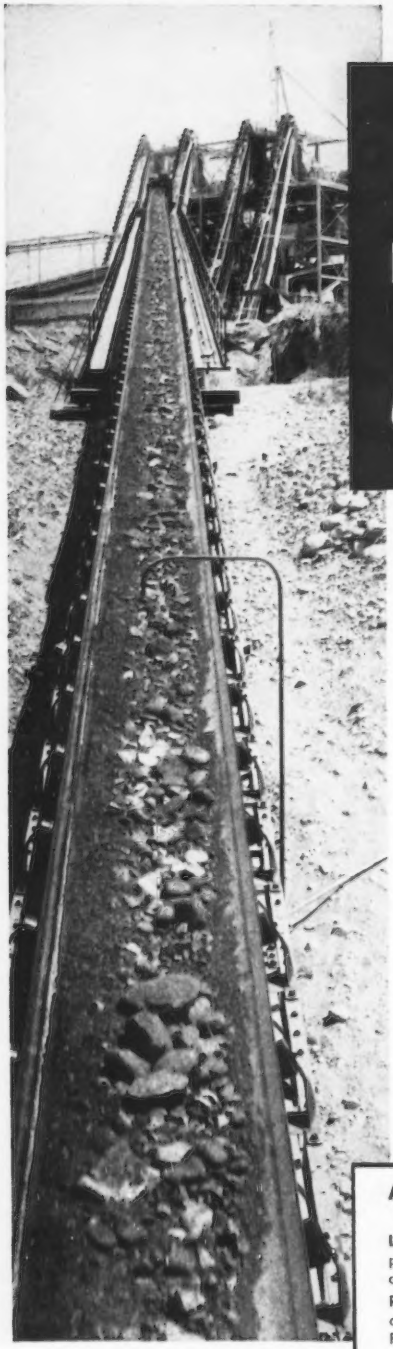

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Colorado *(Continued)*

★**Reports from Uravan** indicate that work is progressing as rapidly as possible on the Golden Cycle uranium project in spite of temperatures as high as 112 degrees. Over 200 ft. of shaft has been sunk. The engineers anticipate it will be necessary to go 650 ft. before actual mining of ore will start.

★**Climax Molybdenum Co.** has a lease and option on claims east of Kokomo, Summit County. The claims are about five miles airline distance from the Climax deposit. Climax plans diamond drilling for molybdenum and tungsten.

★**On the Colorado Plateau,** American Cyanamid Co. is operating a recently completed pilot plant at Grand Junction to test new extraction processes on various types of uranium ore. Another pilot plant has been set up at Monticello, Utah, to attack special problems.

★**Venture Leasing Co.** is operating its 50-ton lead-zinc flotation mill in California Gulch, San Juan County. Venture Leasing is a partnership of C. L. Larson, John Cook and William Gianetto. It has developed the Gold Prince mine and erected the new mill.

FLORIDA

★**Coronet Phosphate Co.** has sold its holdings in Hillsborough and Polk Counties, Fla., to Smith-Douglass Co., Norfolk, Va., for a reported $6,350,000. The Coronet firm, which has been producing about 10% of the national output of raw phosphate, owned large land tracts covering 12,515 acres of land representing 4,116 mineable rock deposits.

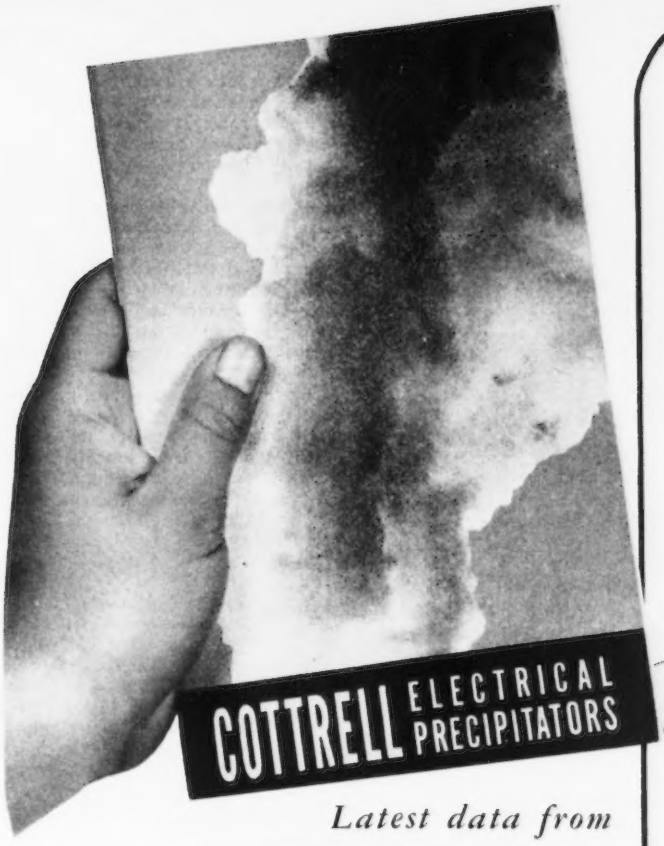
The transaction, completed July 31, has just been announced by George H. Burt, secretary-treasurer of the newly formed Coronet division of Smith-Douglas Co. All stock of the Coronet firm was purchased.

In addition to mining properties, the Coronet firm had a large defluoridation plant near Plant City, Fla.; mines and deposits in Hillsborough County and at Tenoroc in Polk County. Mining facilities at Tenoroc include drying and storage facilities capable of handling 500,000 tons of rock annually.

Smith-Douglass, Inc., of Norfolk, is headed by R. B. Douglass, president. J. R. Sheffield is acting president of the Coronet division. B. G. Dabney, general superintendent of the Coronet firm, retains the same position under the new management.

HAWAII

★**University of Hawaii** has reported finding deposits of titanium oxide in Hawaii which it says are the richest



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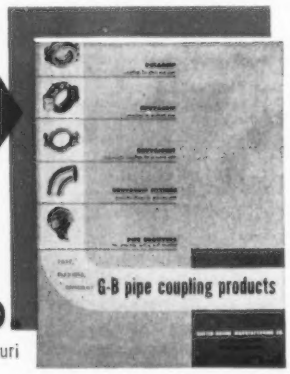

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Hawaii *(Continued)*

in United States soil and rival those of India. The University added, however, that problems of shipping and soil stripping will have to be studied before a commercial appraisal can be given.

Dr. G. Donald Sherman, head of the University's department of soils, reported that Hawaiian soils average a titanium compound of 5% and lavas of 2%. Titanium dioxide was said to be found in Islands' soils in concentrations ranging from 2-40%. In some locations, the deposits may be 20 ft. deep.

National Lead Co. reportedly commented that it has "no evidence" that Hawaii's titanium deposits are commercially feasible. This conclusion, it was added, was based on samples examined in 1946. Samples of the new find were to be sent National Lead Co. by Dr. Sherman.

IDAHO

★**Employees at the** Clayton Silver Mines property in Custer county recently voted unanimously for "no union" in a decertification of bargaining agent election conducted by the National Labor Relations Board. The company's mining and milling operation had been organized by the International Union of Mine, Mill & Smelter Workers about two years ago. Ballots were cast by all eleven employees and the vote against retaining Mine-Mill as bargaining agent was unanimous.

★**Production from** the property of Silver Syndicate, Inc., on Big Creek adjoining Sunshine mine in the Coeur d'Alene mining district, has run about 15% ahead of the 1952 rate during the first six months of this year and the grade of silver-lead ore is also slightly better, President W. M. Yeaman informed stockholders at their annual meeting.

A new exploration crosscut from the No. 4 shaft station on Sunshine's 3700-foot level intersected the Syndicate fault-vein last month at a point midway between the East and West Rambo stoping areas, exposing a 7½-foot width of sub-commercial, but "very encouraging" mineralization. Further exploration of this virgin area by diamond drilling is in progress.

★**Shaft deepening** at the old Hercules mine of Day Mines Inc., has been completed. Three compartments of the four compartment shaft have been sunk to the 1680-foot horizon and station, pocket and sump facilities for a new 1600 level, 400 feet below lowest previous workings from this shaft, are being prepared.

The shaft work is part of a $242,860 DMEA project which provides also for extensive lateral exploration on the new level to probe the downward

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Idaho *(Continued)*

extension of both the old Hercules bonanza orebody, which produced about $80-million worth of metals between 1900 and 1925, and the West Hercules orebody, discovered in 1950 and since developed from the 600 to the 1300 winze level.

★**Rich lead carbonate ore** has been opened by surface bulldozing on the Edith Murray Mining Co. property near Murray, on the north side of the Coeur d'Alene mining district, and the structure has been traced into and across the adjoining Liberty group of claims owned by Richard D. Riegel of Spokane. Trenching on the Edith Murray property has exposed the vein for about 150 feet. Widths run up to six ft. and samples have assayed from 55 to 68% lead, with some silver.

★Sunshine Mining Co., Coeur d'Alene district silver producer, has undertaken a tungsten exploration on Blue Grouse mountain about 30 mi. north of Spokane, Wash., in southern Stevens County. Co-partner with Sunshine in a lease on 80 acres of state-owned land in the area is W. H. West of Deer Park, Wash., who was employed by Sunshine as a hoistman back in 1925.

★**Long-proposed** easterly exploration by Polaris Mining Co. into adjoining properties from the 3,000-ft. level of its Silver Summit shaft—a below-sea-level elevation—got underway late in August following conclusion of the last of the many profit-sharing agreements with owners of the adjoining ground which were necessary to effect the big project.

★**Idaho Custer Mines Inc.,** is planning early resumption of development work at its Livingston Mine in Custer County, following approval of a $97,738 exploration loan by DMEA. The DMEA contract provides for a two-stage program, the second to be contingent upon results of the first. Shaft-sinking, and extensive lateral exploration and diamond drilling at a lower depth are involved.

★**Hypotheek Mining & Milling Co.** has granted a lease to Bres Mining Equipment Co. on the short orebody which has been exposed in the north surface tunnel at its East Hypotheek property on Pine Creek in the Coeur d'Alene district. Recent diamond drilling has proved the extension of the ore downward for at least 150 ft. below the surface tunnel. Proceeds from the lease royalties will be used to finance further development, particularly unwatering the old 300-ft. shaft to determine whether the reported ore showing in the face on that level is the downward extension of the leased orebody. The lease is limited to ore above the 300 level.

★**Several operators** in the Coeur d'Alene District who granted the 8½c hourly wage increase are "contemplating" shutdowns, according to H. J.

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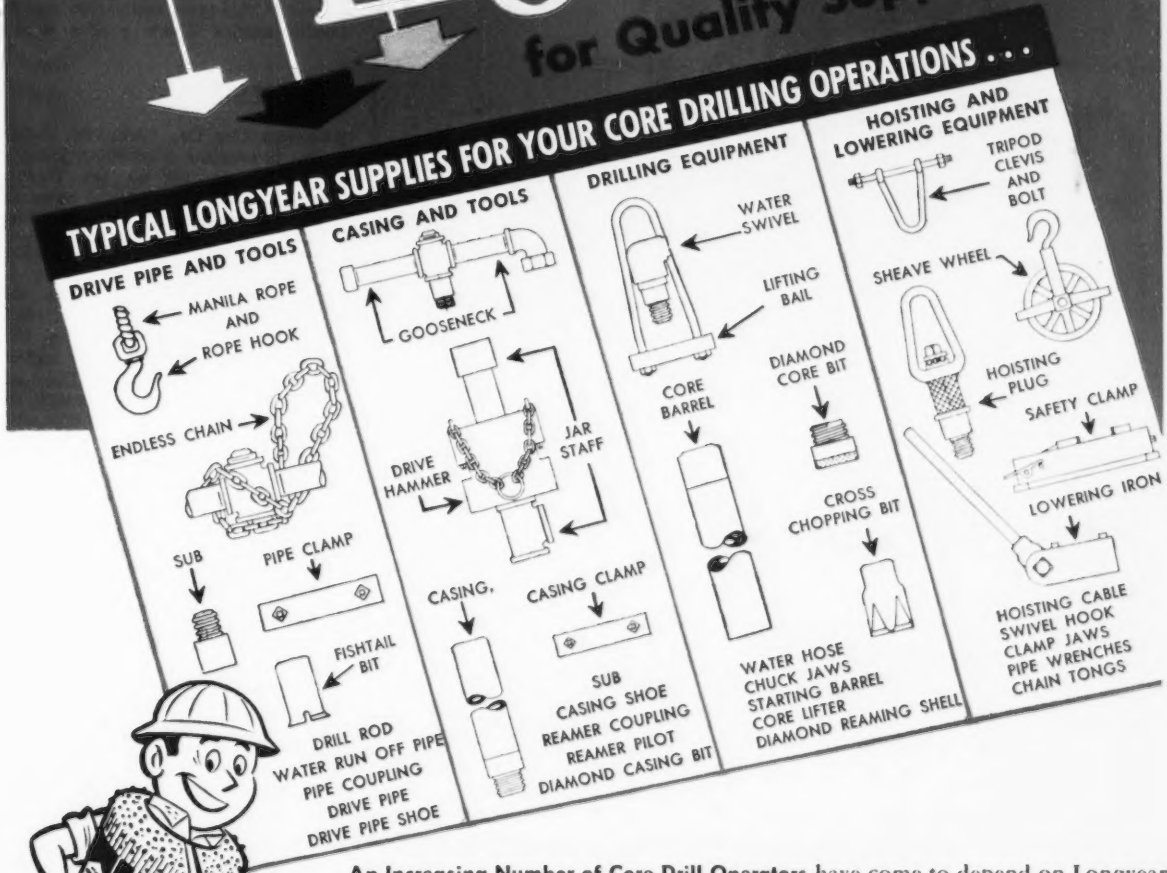

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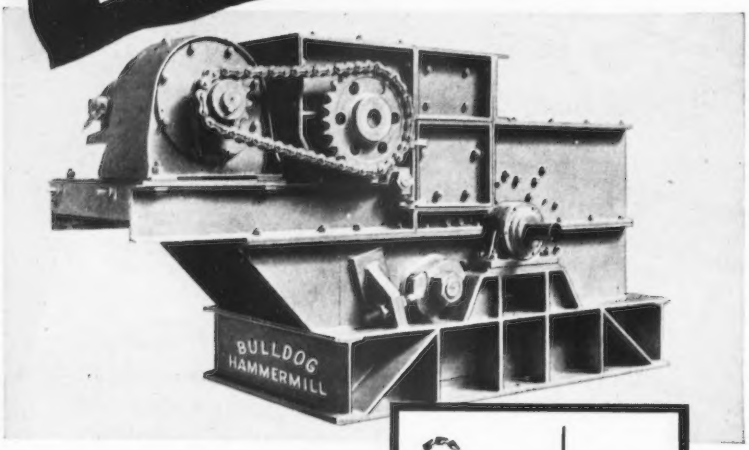

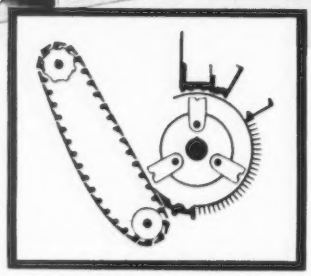

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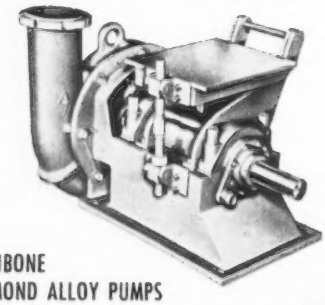

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Idaho *(Continued)*

Hull, who represented 16 operators in negotiations.

Hull explained that many officials do not know whether they can profitably operate their mines under the new wage scale.

Nabob Silver-Lead Mines, of which Hull is president, reportedly will adopt an "incentive leasing" program in part of its workings. In most programs of this type, companies and the leasing-miners divide profits evenly.

MINNESOTA

★**Cuyuna Ore Co.,** Pickands, Mather & Co., is erecting a crushing plant at its Mahnomen pit on the Cuyuna range. A belt conveyor will raise the ore to a loading pocket on surface.

★**Four of the five** open pit mines operated on the Mesabi range by Jones & Laughlin's Minnesota Ore Division have been awarded Certificates of Achievement by the U.S. Bureau of Mines for having had no lost time accidents in 1952. They are the Hill-Annex mine at Calumet, the Longyear at Hibbing, the Columbia at Virginia and the Wentworth at Aurora. The Bureau of Mines announced that these J.&L. mines were among 145 mines, quarries and open pits in the United States which operated a total of over 17 million manhours during the year without a lost time injury.

★**Combination** wash and heavy media type plant at Pickands, Mather & Company's West Hill mine is in operation with shipments being made regularly. The wash ore is shipped directly if suitable. If further treatment is required it is sent to the heavy media unit. The mine, of which L. M. Becker is superintendent, employs about 175 men.

★**New skipway** at Jones & Laughlin's Minnesota Ore Division Schley Mine at Gilbert is in operation and saves more than one mi. round trip truck haul formerly required to bring the pit ore to the surface plant. Trucks now dump their loads directly into the skips. The skips are raised 460 ft. up to a 38 degree incline assuring a steady flow of ore from pit to plant. The South Agnew Mine at Hibbing also has an inclined hoist from the pit and one is planned for the Morton Mine at Hibbing.

★**Fortune Lake Mine** of Pickands, Mather & Co. near Crystal Falls shipped its first ore during August, a little more than one year after a stripping contract for moving 2½ million cu. yds. of overburden was let to Peter Kiewit & Sons.

★**Baltic mine headframe,** located between Caspian and Gaastra, is being dismantled. Formerly the hoisting shaft for the Buck group of Pickands, Mather & Co., it has been replaced by

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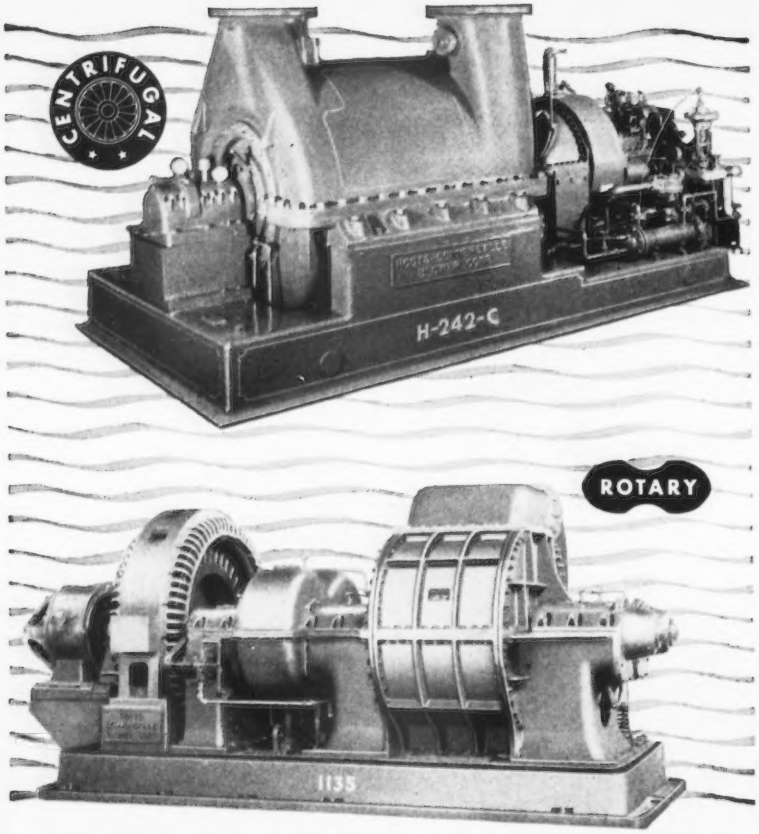

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Minnesota *(Continued)*

the new Berkshire central hoisting shaft in old Caspian.

★**Minnesota State Executive Council** has approved the granting of one year permits to prospect for iron ore on 35 units of state owned lands. Eighty-six bids were received with permits being granted to the highest bidders on these unexplored or partially explored state properties. In 17 cases only one bid was received. The W. S. Moore Co. of Duluth was awarded 10 permits, the largest number to any one bidder. R. Maturi Corporation, Chisholm, and Harry L. Wyman, Minneapolis, received five permits each. Coons Pacific Co., Hibbing; F. L. Palarine, St. Paul; Pacific Isle Mining Co., Hibbing; Pittsburgh Pacific Co., Hibbing, and Sadler Ore Co., Duluth, were awarded two each. Those receiving one permit each were the Haley-Young Mining Co., Hibbing; Sylvia-Dee Mining Co., Buhl; Cleveland-Cliffs Iron Co., Hibbing; U. S. Steel Corp., Duluth, and Western Mining Co., Duluth.

★**New steamer**, Richard M. Marshall of the Great Lakes Steamship Co., loaded its first cargo of iron ore at Duluth August 8th. The 644 ft. carrier took on 17,965 tons of ore for Crucible Steel Corp. It was named in honor of Richard M. Marshall, president of the Pittsburgh Coke & Chemical Co. of Pittsburgh, Pa.

★**J. & L. observation** tower which overlooks Jones & Laughlin Minnesota Ore Division's Columbia pit and also the old Mesabi Mountain open pit mine has attracted an average of 444 cars and 1,886 visitors per week during the summer. They have come from 38 states, Hawaii, India and England. Almost 80-million tons of ore have been removed from the combine pits.

★**Including ore** that is crushed and screened, about 85% of Oliver Iron Mining Division's Mesabi range ore shipments receive some form of processing.

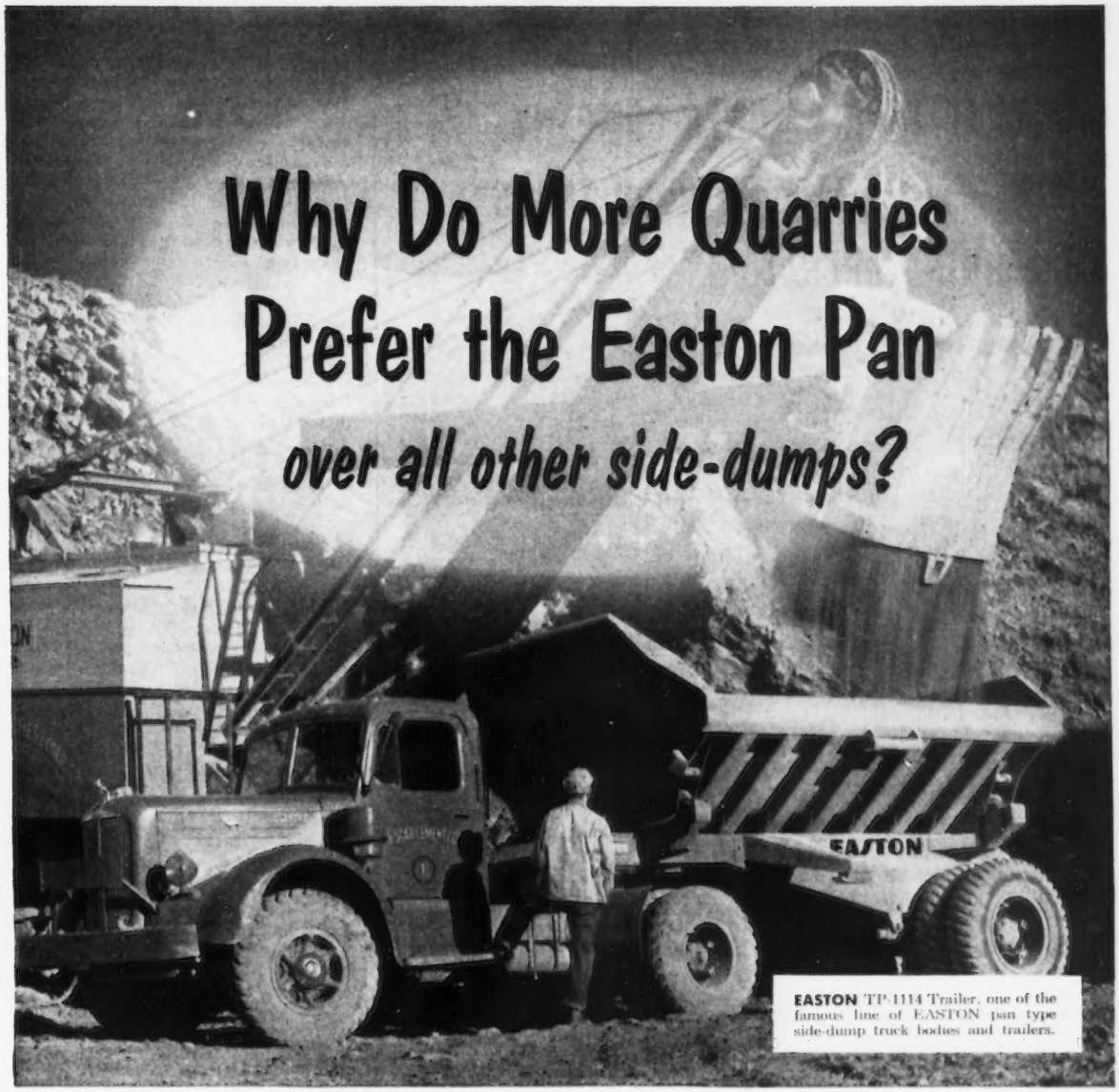
MONTANA

★**American Chrome Co.** has begun production of chromium concentrates at its Mouat mine and mill in Stillwater County.

The company reportedly has spent about $4-million to return the property to operation following its shutdown and the close of World War II. Company has a contract with the government to produce 900,000 tons of chrome concentrates before Dec. 31, 1961.

Current production is about 500 tons daily. This will be increased to a rate of about 300,000 tons annually, it is planned

A specified price has been set up for the concentrate during the first operating year. Using the last three



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INDUSTRY NEWS IN BRIEF . . .

SANTA FE TANK & TOWER COMPANY SHOWS FLEXIBILITY OF WOOD TANKS FOR MINING OPERATIONS

Wood storage tanks have long served as standard equipment for the mining industry. And with the rapid progress of mining, the ever-efficient wood tank continues to play an increasingly important role.

The Santa Fe Tank & Tower Company, Los Angeles, has devoted no less than 50 years to this field. As one of the leading authorities in wood engineering, Santa Fe has succeeded in developing wood tanks to their *maximum* potential. They have multiplied the uses for wood tanks in mining operations by offering *flexibility* in sizes, shapes and field erection. Actually, the capacities of wood tanks are almost limitless... measuring, for example, from 50 gallons to almost 2 million gallons in capacity. These tanks are built in many shapes, according to customer requirements. The diameters likewise vary from 2 feet to as much as 120 feet, or even more. Santa Fe engineers emphasize that "there is almost no limit to what can be done with wood tank construction." They have also been found to be easily *dismantled*, and then *re-erected* in other localities.

Wood tanks are now universally accepted for almost all mining operations... gold, silver, copper, uranium, to mention a few. For the storage of water, acid solution, leaching plants and other mining operations, wood tanks are desirable for their resistance to corrosion. Serving almost any storage purpose, they have the ability to withstand constant use for many years. Maintenance costs are generally very low, particularly since painting is not required.

The installations shown here were designed and fabricated by the Santa Fe Tank and Tower Company. Additional information (Mining Bulletin M-45) is available by writing Santa Fe, 5401 S. Boyle Ave., Los Angeles 58, California. Engineering data is also available on Wood Pipe, Cooling Towers, Cylindrical Gas Scrubbers, and other industrial wood specialties. Santa Fe maintains branch offices in all principal cities.

Montana *(Continued)*

months of the operating year as a base, a price then will be keyed to the cost of production. This price thereafter will be subject to an escalator clause, based on Bureau of Labor indices. Ore found at Mouat is picatite.

Mine is named after William Mouat, present owner of the claims, who came to Montana in the early part of the century and staked many claims without placing a high value on the chrome ore.

President of the company is Estey A. Julian. Frank Eichelberger, Spokane mining engineer, is vice president. Willis A. Swan is secretary-treasurer. John Bly, formerly of the Chelan Copper Division of the Howe Sound Co., is manager of the property.

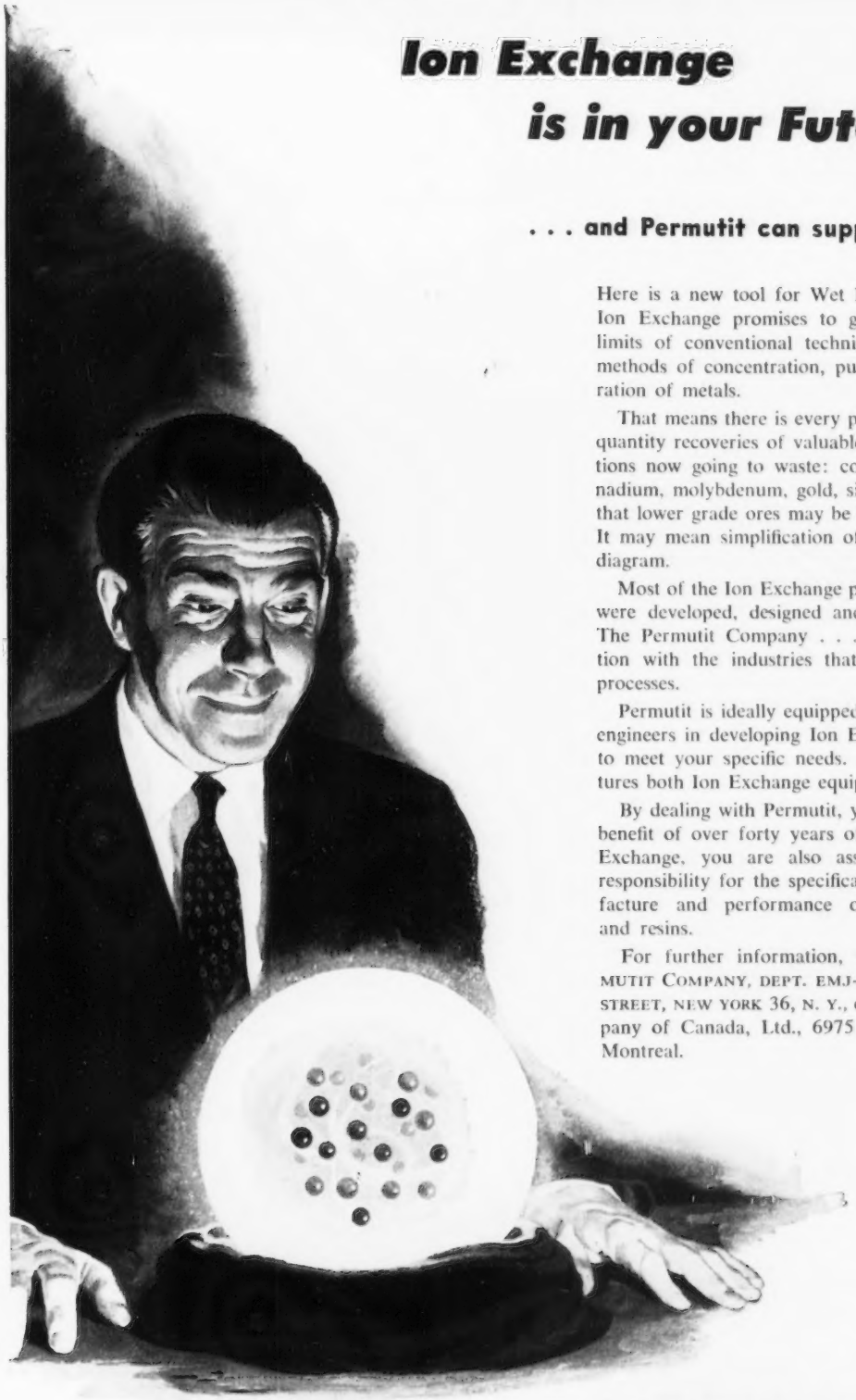
★**Minerals Engineering Co.,** Grand Junction, Colo., of which Blair Burwell is president, is now constructing a flotation plant of 300 tons daily capacity for treating tungsten ores from the Brown's Lake and Lost Creek mines of the Mineral Engineering Co. and the American Alloy Metals, Inc.

The new mill will be close to the mines and is located 4 mi. northwest of Glen (P. O. name Reichle), Beaverhead County, Mont., nearly 40 mi. south of Butte in a tungsten district which has been under development by the two companies mentioned for several years. The mill will be placed about one mi. west of the Big Hole River bottom to prevent pollution of that stream.

A 7,000-ft. water line is being installed to serve the concentrator from wells in the vicinity, and the Montana Power Co. is connecting this tungsten development with a high tension line from Maiden Rock, Montana. Salt Lake Tungsten Co., which is owned by Minerals Engineering Co. and Sylvania Electric Products Co., is completing construction of its refinery in Salt Lake City and will receive and process the flotation concentrates from the Glen mill as well as other concentrates available from the general Rocky Mountain area.

★**Anaconda Copper Mining Co.** has contributed $10,000 towards the creation of "Mining Frontier" room at the Montana State Historical Museum in Helena. The company also will furnish technical advice for the exhibit, as well as samples of ores and pictures. The display will be arranged chronologically to trace development of Montana's mining industry. According to present plans, the entire mining display of the state will cost around $60,000, of which the 1953 legislature appropriated about $20,000. It is estimated that $30,000 will be raised by popular subscription.

★**AEC may now** buy uranium-bearing ores assaying more than 0.15% U_3O_8 at the railhead nearest the mines. This was announced by Leonard D. Jarrard, chief, AEC Butte Sub-Office, who explained that this arrangement will make it possible to profitably



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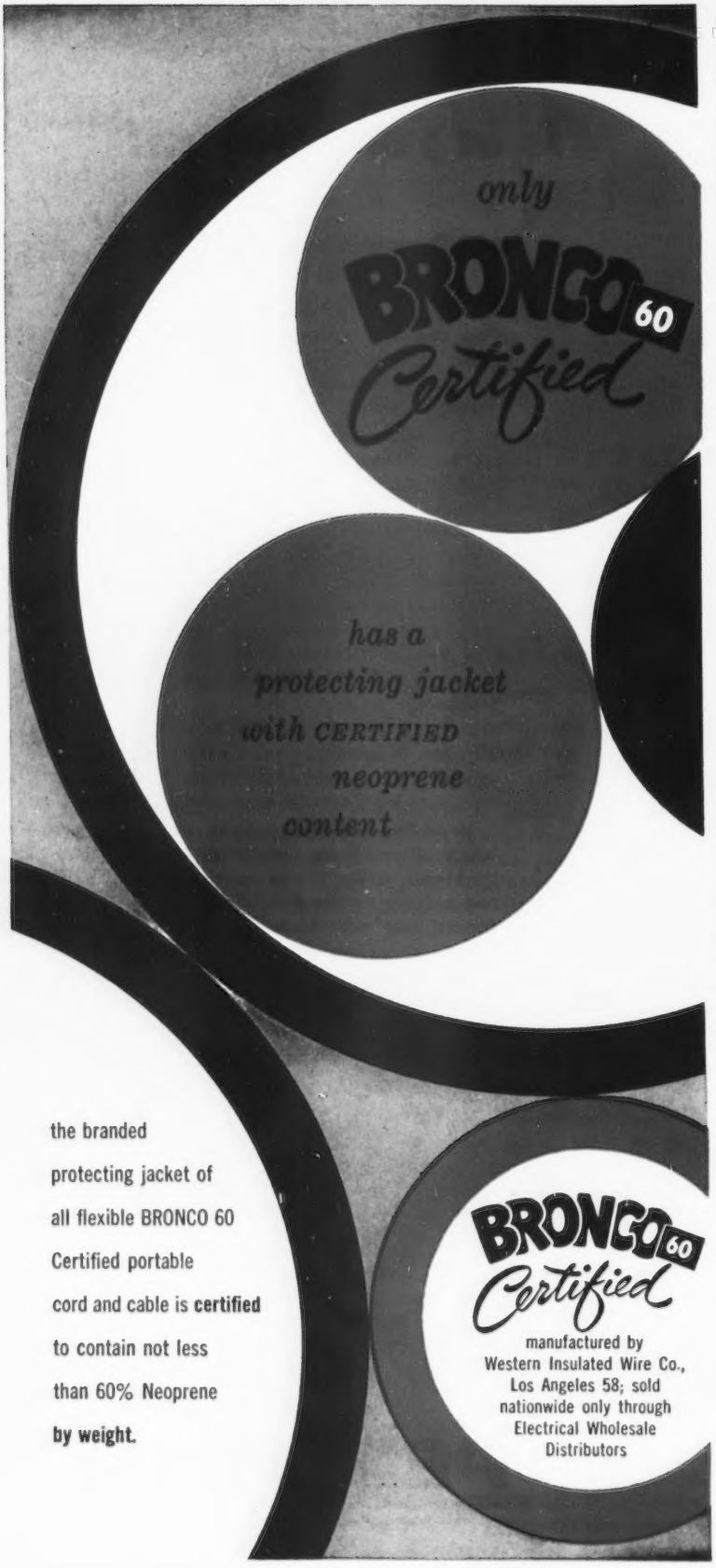

Montana *(Continued)*

mine and ship ore heretofore considered marginal.

Jarrad added that diamond drilling is now underway at the Boulder Batholith, Jefferson County. The drilling is being done by the Minerals Engineering Co. of Grand Junction, Colo.

★**Four unions** overwhelmingly approved—4,067 to 688—ratification of new contracts agreements reached August 28 by union negotiators and officials of the Anaconda Copper Mining Co. Unions were listed as the Butte Miners Union, Anaconda Mill & Smeltermen's Union, Great Falls Mill & Smeltermen's Union and the Butte Stationary Engineers Union.

New contracts reportedly include a general increase of 7½¢ an hour, retroactive to July 1, 1953; an additional 50¢ per employee per month contribution by Anaconda for employees' hospitalization system, liberalization of the paid holidays clauses and other fringe benefits.

NEVADA

★**The new Big W** tungsten mill recently constructed on Winnemucca Mountain by the Winnemucca Mountain Mining Co. is now in full operation following test runs made early in August. The riffling process quadrupled its production following the first ten days of operation, and the output is now averaging 200 lb. of graded tungsten daily. Water for the mill comes from a spring above the plant, and a water-recovery system has been installed to insure all current and future need. Officers of the company are O. R. Maunula, president, William D. Craft, vice president, and Gus Rogers, secretary treasurer.

★**Linka tungsten mine**, near Austin, is operating three shifts daily. In addition to carrying the shaft to greater depth, tunnels are being carried off into the ore formations which are showing much promise. Workmen are being transported to and from Austin, and officials of Uranium Mines of America, owner of the Linka property, say they have no intention of building a boarding house at the mine site. Road building and similar preliminary developments are being pushed ahead rapidly to put into production the company's other properties in Washington Canyon. Wells Cargo Co. is building the road under direction of Lloyd DeNeui.

★**At the Mohawk mine** in the Argentite district of Esmeralda County a north drift on the 218-ft. level has encountered a new orebody of payable width and grade in an unexplored section of the mine. The discovery was made during development work on the property. Formerly known as the Bruhi property, the mine was taken

(Continued on page 162)

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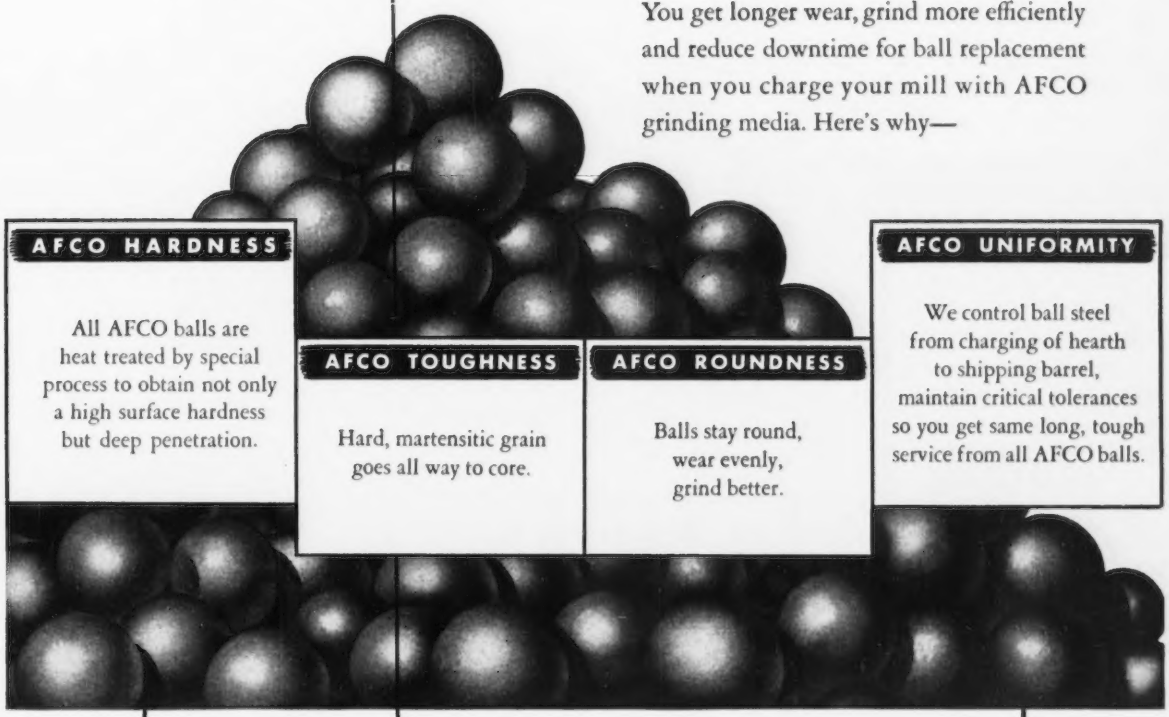

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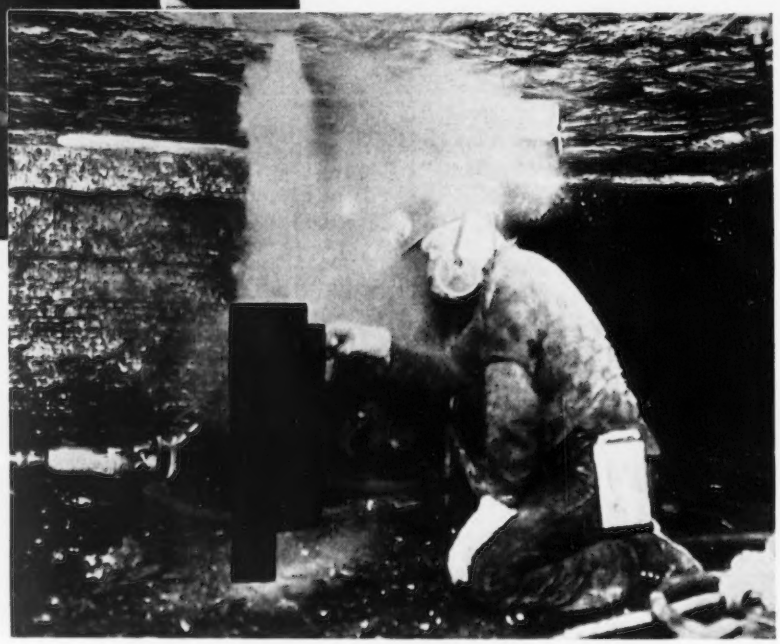

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TELEPHONE: CAMBORNE 2275 (9 lines) SUBSIDIARY COMPANIES. BRANCHES

-with the Holman DRYDUCTOR

- Makes roof bolting cleaner, easier and more efficient.
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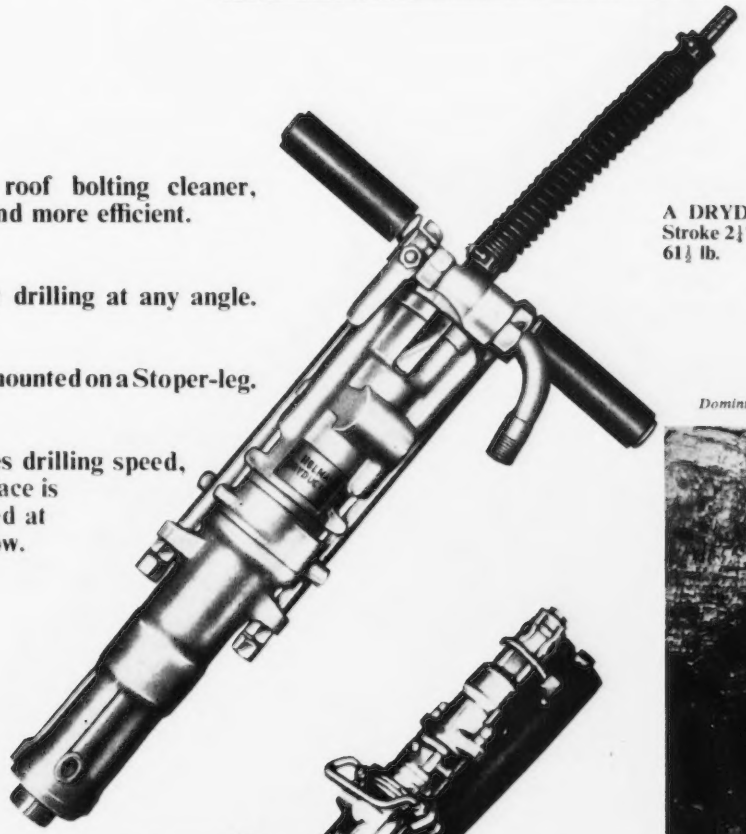
- Can be mounted on a Stoper-leg.
- Increases drilling speed, as new face is presented at each blow.



A DRYDUCTOR. Bore 2⅛". Stroke 2¼". Length 26". Weight 61¼ lb.

Photographs by kind permission of Dominion Steel and Coal Corporation, Sydney, Nova Scotia.

▲ *Holman Dryductor driving roof bolt into place, using a driving head in the chuck of the drill.*

▼ *Raising with the Holman Dryductor.*

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SETTING THE PACE IN CHEMICAL PURITY SINCE 1882
*Complete stocks carried here

Nevada *(Continued)*

over some months ago by the Sunshine Mining Co. of Idaho. Robert M. Hardy Jr., assistant to the general manager, is in charge of the work.

★**During less than seven months** of operation Tom Hancock and Hank Baxter have shipped 3,000 tons of ore from their Big Top mine near Gabbs. Mining is being done by the open pit method, and the ore is assaying on an average about 3% WO_3. Bill Bennett, of Fallon, has contracted to do the trucking and stripping, and the ore is being treated at the Sodaville mill and the Vanadium Corp. mill at Bishop. Hancock and Baxter discovered the tungsten deposit last fall at the 8,000-ft. level. Plans now are to work through the 35-ft bench on the mountain side, sink a 100-ft. shaft near the orebody, then to cross-cut to determine the extent of the scheelite.

NEW MEXICO

★**Kerr-McGee Oil Industries Inc.** has contracted with the Atomic Energy Commission for construction and operation by Kerr-McGee of a uranium ore processing plant at Shiprock, N. M.

AEC for the past two years has operated a sampling plant at Shiprock. Ores produced in the northern part of the Navajo Indian Reservation have been stockpiled pending construction of a processing plant.

Construction and operation of the plant will be undertaken by the Navajo Uranium Division of Kerr-McGee. Clyde Osborn, manager of operations, is in charge of mining and milling activities, and G. R. Kennedy is manager of exploration. Actual milling of uranium ore is scheduled to begin in 1954.

Execution of this contract brings to ten the number of uranium ore processing plants either in operation or under construction in the Colorado Plateau region. Contract was announced by Sheldon P. Wimpfen, manager, AEC Grand Junction Operations Office.

★**Chino Mines Division,** Kennecott Copper Corp., and Local 890, International Union of Mine, Mill & Smelter Workers have signed a two-year contract giving workers a 9¢ an hour wage increase. Contract runs until June 30, 1955, but has a provision for reopening discussion on wages next year. Covers 1,000 IUMMSW members at Santa Rita and Hurley.

★**Bureau of Indian Affairs** opened bids Sept. 8 for prospecting some 10,000 acres of land belonging to the Canoncito Navajos 30 mi. west of Albuquerque.

Area covered includes parts of four townships lying northeast of the Laguna Indian reservation, where considerable uranium prospecting is now under way.

When rust is kept out of the gutters...

Eagle-Picher zinc for galvanizing is doing the protective job. It serves in the manufacture of steel gutters, elbows and downspouts for water drainage on buildings and homes.

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America's leading manufacturers of galvanized products prefer Eagle-Picher as the source for slab zinc. There may be a need for zinc and for Eagle-Picher's experience in your own operations. We'd be glad to talk it over. Write Eagle-Picher Zinc Sales Office, Miami, Oklahoma.

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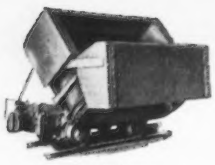
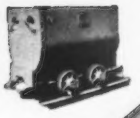


Granby-type Dump Cars

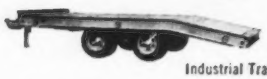


Mining Cars

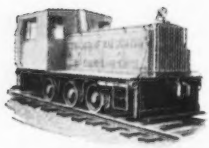
Tray-type double Side Dump Cars

Cradle Dump Cars

Profit-making Performance to meet your *Particular* needs...



Industrial Trailers



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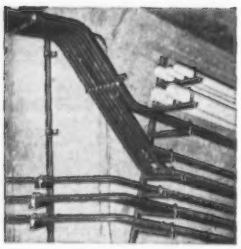
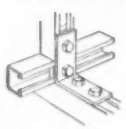
in all Pressed Steel Car Company Equipment!





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New Mexico *(Continued)*

Prospectors making a discovery will be given a mining lease. Prospector must start work in 30 days, employ Indians in all jobs for which they are suited at prevailing wages, make every effort to advance Indians into skilled, technical and other higher jobs.

★**A mechanical sampling plant** has been placed in operation at the government's Manganese Ore Purchasing Depot at Deming. Otto G. Klein, regional director of the General Services Administration in Denver, said the plant could handle more than 1,000 tons a week.

"The mechanical sampler replaces the hand method of sampling and will speed up processing of the ore," Klein said. "The volume of ore being purchased made it uneconomical for the government to continue the hand-sampling method employed since the depot was reactivated in November, 1951."

The Deming ore purchasing depot was established as a part of the federal government's purchasing program to encourage the discovery, development and production of manganese. Funds are available for the purchase of a total of $6 million contained long dry ton units at Deming.

NORTH CAROLINA

★**Department of Interior** has awarded nine new mineral exploration contracts in North Carolina, all for mica.

Six of the contracts are located in Macon County, and the other three are in Mitchell, Yancey and Avery Counties. Estimated cost of the mineral explorations is $55,190, of which the government's share is $47,771.

Contracts were awarded to the following in Macon County: American Mica Corp.; Richard C. Angel; Ray E. Bennett; J. P. Bryson, Luther Raby and Walter Tippett; Roy Herbert Fouts, and Hardy Calvin Cable.

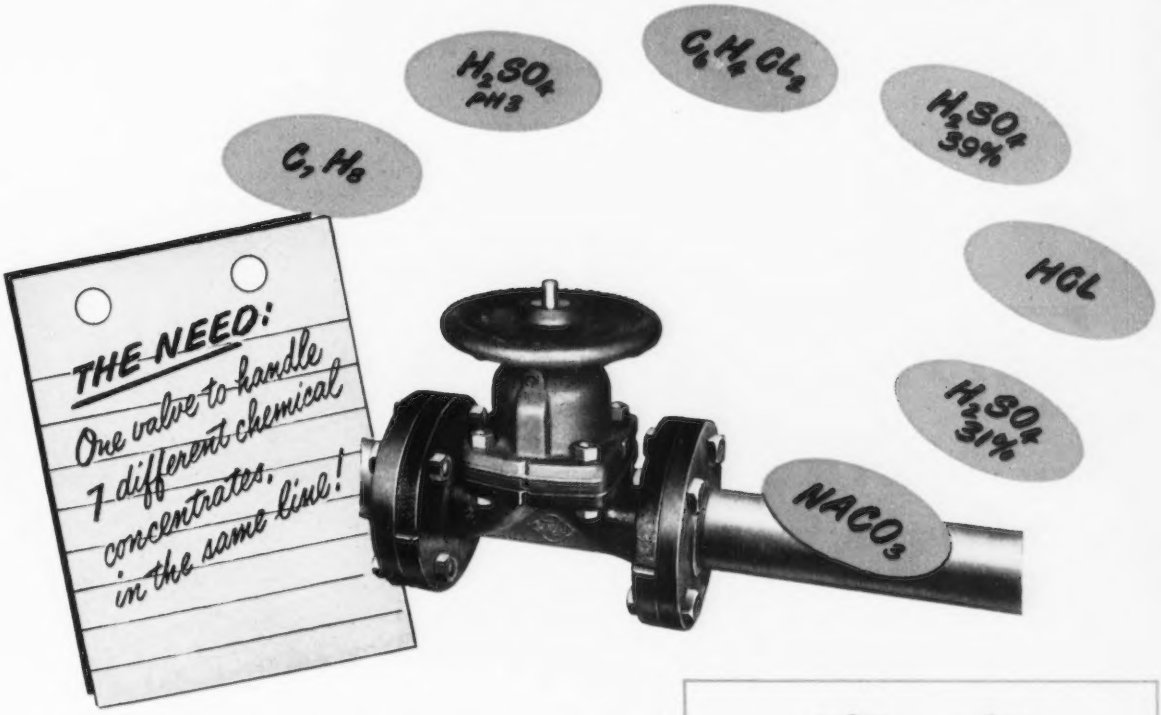
Others awarded contracts were: The Duncan Mining Company in Mitchell County; Ben L. Ray and C. E. Hyde in Yancey County; and Fred Taylor and Julian and Johnnie Green in Avery County.

★**Developing and mining** operations to reactivate the old iron mine at Lansing, in Ashe County, on the Joseph Graybeal tract has been started with a view to bringing it into production.

★**Shalite Corp.**, of Statesville, has obtained a certificate of incorporation from the North Carolina secretary of state to search for ores and minerals with authorized capital stock of $100,000. Incorporators are A. B. Raymer, Juanita Shaw and Charlie Fay Murdock, all of Statesville.

★**DMEA has signed** a contract with Fred Taylor, Julian Greene and Johnnie Greene, all of Newland, N. C., for mica exploration in Avery County,

What valve would you specify?



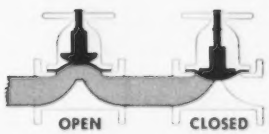
A manufacturer was looking for *one valve* which would handle *seven chemicals* of varying temperatures and concentrations, one after another, in the same line. They were . . .

SODIUM CARBONATE	PH 9	90°C
HYDROCHLORIC ACID	8%	100°C
SULPHURIC ACID	PH 3	20°C
SULPHURIC ACID	39%	42°C
SULPHURIC ACID	31%	15-20°C
TOLUENE	*(Full strength but associated with traces of other chemicals)*	

ORTHODICHLOROBENZENE — **Cleaning Solvent**

Valves suitable for use with these chemicals individually were available. But only *one valve* was found which could handle them in combination. It was the Grinnell-Saunders Diaphragm Valve, glass lined, with chemically inert KEL-F Diaphragm. The Grinnell KEL-F diaphragm not only prevented the liquid from attacking working parts, but it eliminated leakage around the stem.

Piping in today's complex industrial plants is an exacting science involving the handling of highly corrosive fluids, gases, compressed air, beverages, foods and suspended solids . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors. Under such conditions, the amazing adaptability of the Grinnell-Saunders Diaphragm Valve explains its acceptance by industry after industry. For further details, write for Grinnell-Saunders Diaphragm Valve Catalog.



Features which have made Grinnell-Saunders Diaphragm Valves the specified valve in many different industries:

Streamlined flow. Smooth, streamlined passage, without pockets. Frictional resistance at a minimum.

Leak-tight closure against grit, scale, suspended solids.

Working parts absolutely isolated from fluid. Diaphragm completely seals off working parts from fluid in the line.

Body, lining and diaphragm materials to meet service condition. Bodies stocked in cast iron, malleable iron, stainless steel, bronze and aluminum; other materials on special orders. Valve bodies lined with lead, glass, natural rubber or neoprene. Diaphragm materials of natural rubber or synthetics.

Minimum maintenance. No refacing or reseating is required. No packing glands to demand attention. New diaphragm can be inserted without removing valve body from the line.

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WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

North Carolina *(Continued)*

N. C. The contract calls for the total expenditures of up to $5,450, of which $4,905 will be advanced by the government.

★**National Labor Relations Board** has upheld findings of a trial examiner that a United Mine Workers strike for recognition at the Tungsten Mining Corporation's mine in Vance County, N. C., last January was illegal, and placed responsibility for the strike on the union and two of its officials. The three-week strike, NLRB held, was "a clear violation" of the Taft-Hartley Act, according to the field reports.

OREGON

★**Lucky L & R Mine** is among the new chrome producers in Josephine County. Bob Radcliffe and Al Lea, who are working the property, have shipped about 50 tons of ore all of which assayed 52% Cr_2O_3 or more. Some of their low-grade ore is being stockpiled at Radcliffe's mill, 3 mi. northwest of Galice.

★**Six Mile Creek** chromite concentrating mill, owned by Floyd, Pressler, and Jackson, and located about 8 mi. west of Selma in Jackson County is now milling ore from the Jackson Creek Mine.

★**An exploration project** for mercury in Crook County was among the 46 new contracts approved by DMEA on July 22, 1953. Total contract is for $5,600, the Government's share being $4,200, the remainder being paid by Morris L. and Charles J. Page.

★**Canadian Johns-Manville Co.**, represented in Oregon by John Gill, geologist of Bates, has called on prospectors of the state for information on sources of potential commercial deposits of serpentine asbestos. Prospectors are asked to forward samples to the company in care of Gill at the Bates office.

★**Robert Radcliffe and Al Lea,** who staked the Lucky L&R claim last November on Chrome ridge in Sec. 35, T. 35 S., R.9W, Josephine County, are working the claim. A half mi. road was completed in late spring and by mid-August they had hauled nearly 50 tons of ore, none assaying less than 52% Cr_2O_3, to the Grants Pass GSA depot. Low grade ore is being stockpiled at Radcliffe's mill at his gold mine near Galice.

Other chrome field activity in Josephine County includes:

Ashland Mining Co., Ashland, operated by Fred and Dewey Van Curler, has a leasing agreement with Dana Bowers to work any of the old Sordy claims not being worked by Bowers and also has leased the Catty Buck claim of Lou Robertson. Meanwhile, Lou and Bill Robertson have leased the Sad Sack, formerly known as Black Prince, from C. O. Russell and C. O. Anderson. The Robertsons have driven a 300-ft. tunnel about 60 ft. below the open pit work done last summer and are mining a stringer of high grade ore, which is believed an extension at depth of a pod mined near the surface. In another operation, Bill Robertson has leased the Jim Bus mine west of Selma from J. Gallaher and C. O. Russell. A low-water bridge has been built across the Illinois River near the site and an inclined shaft is being sunk alongside a prominent diorite dike where a fairly large pod of chromite occurs.

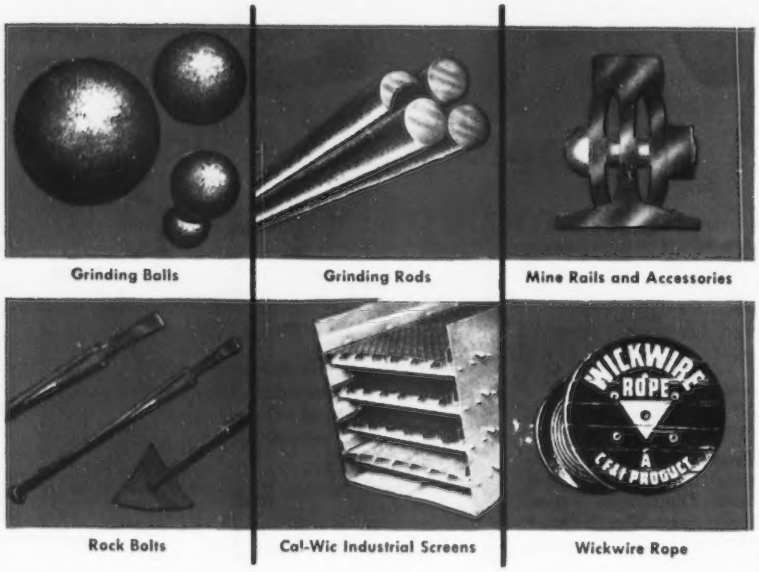
TENNESSEE

★**Appalachian Mining & Smelting Co.** is putting into operation its zinc processing plant at Embreeville and will employ what is said to be a new process for the recovery of zinc from tailings in ponds of iron mines.

Initial operations will be toward fulfillment of a $3,500,000 contract to furnish the federal government with 10,000 tons of slab zinc, according to G. R. Warren, president. It is estimated that it will require three years to complete the contract.

Mr. Warren said that the plant will initially process some 85,000 tons of zinc ore in tailings ponds of iron mines formerly operated in the Bumpus Cove area. This ore tests out 15% zinc.

CF&I STEEL PRODUCTS FOR THE MINING INDUSTRY



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Rock Bolts | Cal-Wic Industrial Screens | Wickwire Rope

From ore to the finished product—CF&I mining specialties are products of a completely integrated operation. They are manufactured to the highest standards of quality recognized by the mining industry. The CF&I Pueblo Plant maintains strict quality control to assure products of top performance and value.

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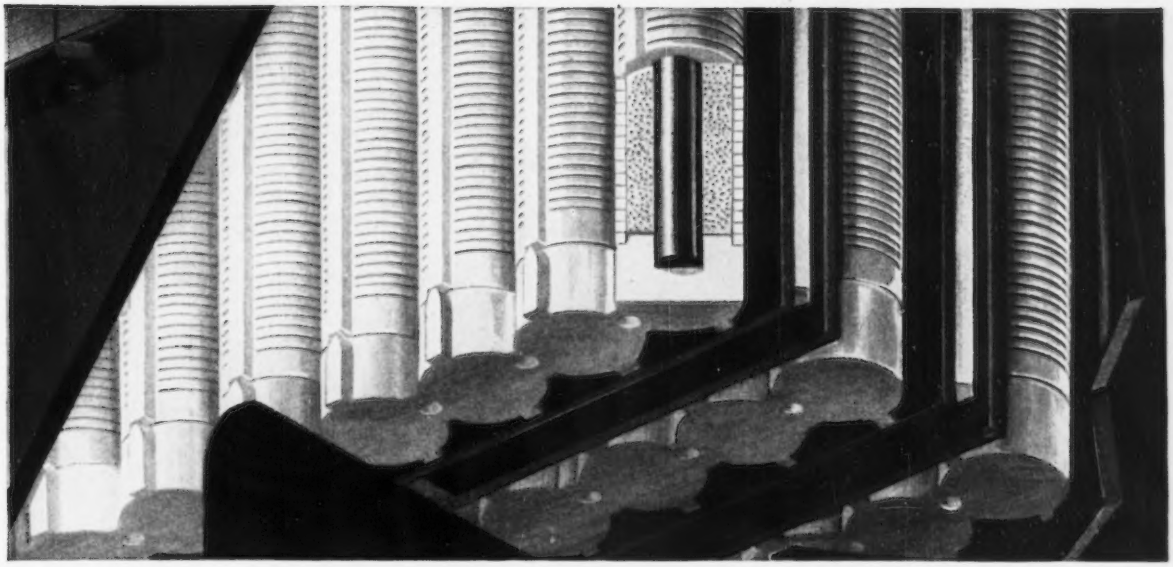
For Mine haulage . . . Exide-Ironclad now offers

★ 20% more capacity in the same space

★ Lowest cost per A.H. to own and operate



This cutaway picture shows the inside of the new T H EXIDE-IRONCLAD Battery.

Its larger positive plates, containing corrosion-resistant Silvium, are different . . . unique . . . exclusive! No other type of positive plate construction offers you the advantages of the T H Exide-Ironclad, with its slotted plastic tubes, permanently sealed on the bottom with polyethylene tube sealer. More active material is exposed to the electrolyte, resulting in greater power. More active material is retained, providing higher battery capacity for a longer working life. Other features include improved negative plates... practically indestructible Pormax separators . . . new sealing compound . . . shockproof molded jar . . . unbreakable quarter-turn vent plugs of plastic . . . corrosion-resistant tray coating.

All of the features of the new T H Exide-Ironclad Battery construction provide direct operating-hour savings for you.

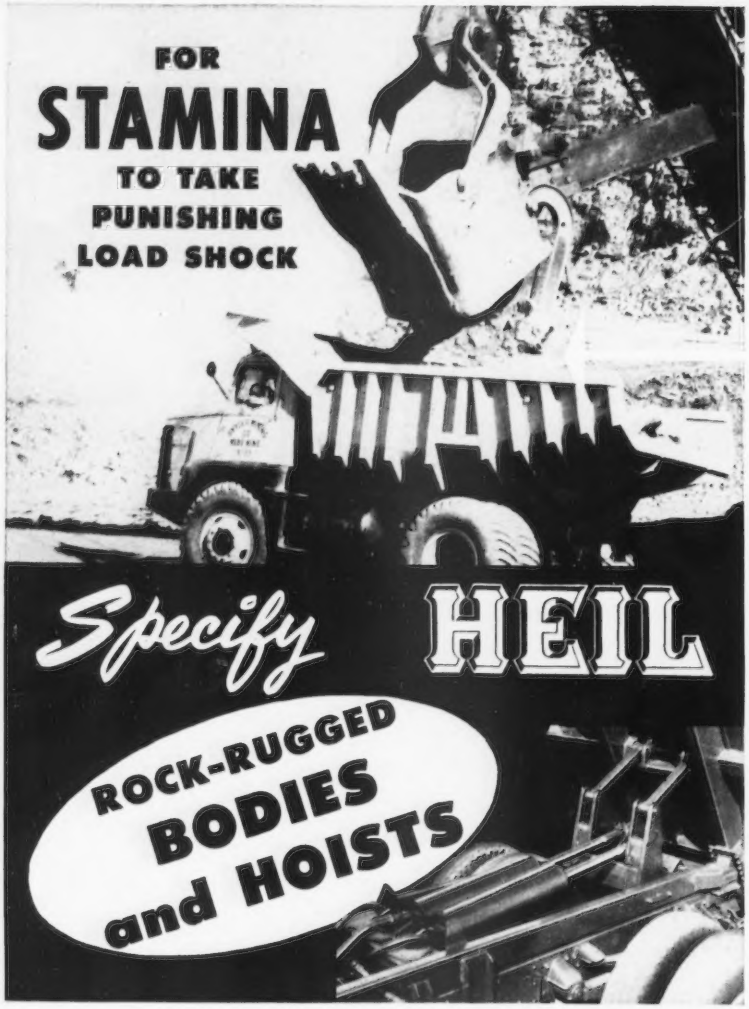
Now-more than ever before...
YOUR BEST POWER BUY AT ANY PRICE!

1888... DEPENDABLE BATTERIES FOR 65 YEARS...1953

The new T H Exide-Ironclad BATTERY

Thrifty Hauler

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 2 • *Exide Batteries of Canada, Limited, Toronto*
"EXIDE", "EXIDE-IRONCLAD", "SILVIUM", "PORMAX", *Reg. T. M. U.S. Pat. Off.*



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BH-10

HEILINER 13 AND 18-CU. YD. SCRAPERS

HEILINER 20-CU. YD. BOTTOM DUMP WAGON

CONTRACTOR'S BODY

Tennessee *(Continued)*

The plant will operate a new process which is said to show 95% efficiency in converting the zinc ore into zinc oxide. This will be shipped by rail to a New Jersey firm which will further process it into slabs for shipment to the government.

After the zinc processing is under way the company plans to open Lick Log Mine for strip mining of zinc ore. This operation will require about a year of preparation. Operation here will require about 150 additional employees.

Mr. Warren said that the company required about $600,000 for buildings and equipment for the operation. The firm has some $1-million in the plant and 13,000 acres of mine property.

There are 13 zinc and lead mines and five manganese mines on the property. Tennessee Manganese Co. is soon to open one of the manganese mines.

★**The Crane Co.** has announced that Chattanooga, Tenn., has been selected as the site for construction of Cramet's $25-million titanium plant. The new project, scheduled to produce 6,000 tons of sponge titanium metal a year, is expected to go into production in 1955. The site comprises about 200 acres and is located about 2 miles downstream from TVA's Chicamauga Dam. Cramet Inc. is a wholly owned subsidiary of the Crane Co.

UTAH

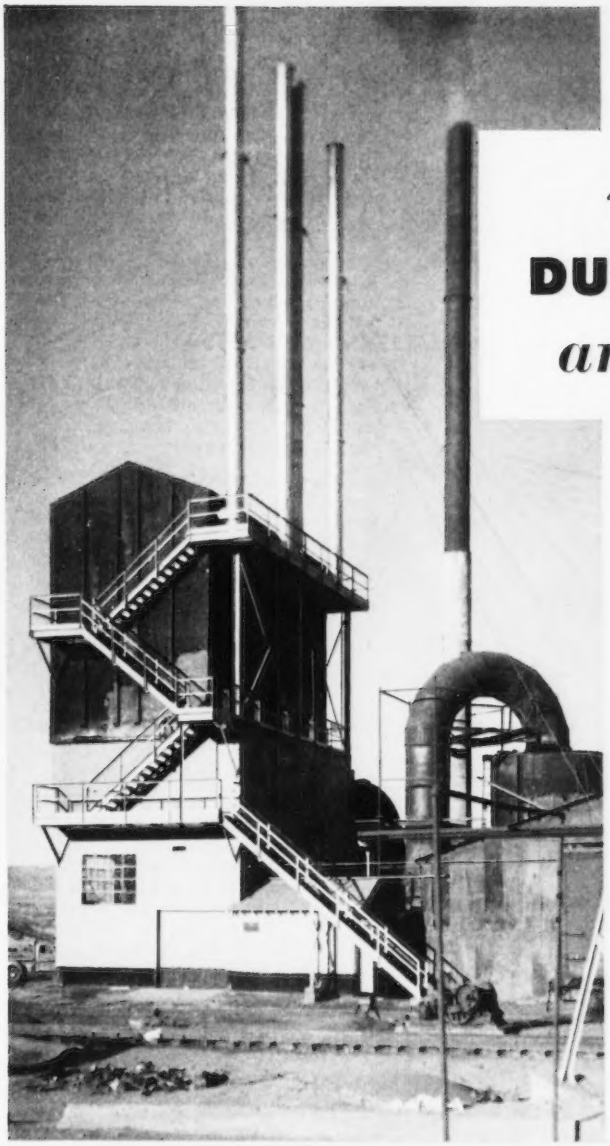
★**Officials** of the newly-formed Salt Lake Tungsten Co. hoped to have the firm's refinery operating by mid-September. The company is a joint affiliate of the Mineral Engineering Co. and Sylvania Electric Products Co.

★**Utex Exploration Co.** has announced that it is considering the possibility of building a uranium processing mill near Moab. Probable cost was estimated at $3-million. Charles A. Steen, discoverer of the famous Utex mine, emphasized, however, that construction of the mill is only a possibility, still under consideration. Ore from Steen's Mi Vida Mine is now being stockpiled at Monticello until processing methods are developed to handle it.

★**Charles Steen,** Moab, and Mitchell Melich, Moab attorney, have reported a new uranium find "which may be extensive" north of the Utex Exploration Co.'s Big Indian Canyon Mine in San Juan County. Steen is president of Utex, and discoverer of the richest A-ore claim yet located in the nation.

The new discovery was reported on properties of Utex, and are said to be "two claims north" of the Big Indian Canyon strike. Steen termed the discovery "extensive," with diamond coring said to have brought 3% ore to the surface.

★**Utah State Tax Commission** has



Custom designed continuous automatic Dustube Collector filtering 25,000 c.f.m. gases from a Dwight-Lloyd Sintering Machine at the New Jersey Zinc Company, Empire Zinc Division, Canon City, Colo.

4 reasons why **DUSTUBE® collectors** *are your best buy*

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of the fume entering the Dustube cloth type collector are commonplace. It is the most dependable method of dust removal that will insure a "clean stack" under wide variation in operating conditions.

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4. APPLICATION ENGINEERED

Dustube Collectors are available in either standard units or they can be individually designed to fit existing or new plant buildings and flue lines. Collected material can be automatically discharged and conveyed to a common point for reprocessing without dewatering, filtering or drying.

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dustube® COLLECTORS

Utah *(Continued)*

billed the Kennecott Copper Corp. for $4,851,689 for alleged tax deficiencies extending from 1942 through 1950. A statement of findings and conclusions on the dispute was filed (Aug. 27) in Utah Supreme Court by the commission.

Kennecott received its "bill" earlier, and filed for a writ of certiorari in late August.

★**W. H. H. Cranmer and John Archer,** Salt Lake City, have announced sale of a phosphate lease at Rex Peak, Rich County, to J. R. Simplot, Boise and Pocatello, Ida.

Sale calls for a 10% overriding royalty on acid grade rock (for fertilizer manufacture) and a 5% royalty on electrical furnace grade rock (for elemental phosphorus production). Some $25,000 will likewise be paid for the lease over "a period of a few years."

★**Additional public lands** in the Utah area south of Blanding, San Juan County, have been set aside for uranium exploration.

WASHINGTON

★**Sunshine Mining Co.,** silver producer of the Coeur d' Alene district, has bought a half-interest in a tungsten location 30 mi. north of Spokane in Stevens County, Wash.

Sunshine took a half-interest in a lease on 80 acres of state land on Blue Grouse Mountain, about 10 mi. north of the town of Deer Park. Once known as the Tungsten King Mine, the property has been renamed the Little King, and Sunshine has begun a new tunnel at 3700 ft, about half a city block from an abandoned older shaft.

The other half-interest in Little King belongs to W. H. West, who mined a nearby property—Deer Lake Tungsten—during World War II with James Keith of Spokane and took out $40,000 worth of tungsten. West supervises the Sunshine crew at Little King and general operations are directed by Rowland King, Sunshine exploration engineer.

★**Pacific Northwest Alloys Inc.** started production of ferrochrome at its Mead plant August 18, H. B. Megill, executive vice-president and general manager, reported. The company recently leased the plant from the government. It had been manufacturing magnesium for the government previously, and can switch back to production of magnesium should the need arise. One of the four arc furnaces is being used with rate of production about 1,500,000 lbs. high carbon ferrochrome monthly. Another furnace is producing ferrosilicon.

★**Big Q Tungsten Mine Inc.,** a Seattle company, is working on the north side of Blue Grouse Mountain at the old Deer Lake tungsten property in Stevens County, on the opposite side of Sunshine company's development. Operations which started last fall with a 25-ton mill were shut down after 1,150 lbs. of concentrates were produced. Equipment is being added in order to secure a higher grade of concentrates. A 97-ft. raise was completed in August from the end of the 600-ft. main adit. The company estimates 67 ft. of tunneling from the top of the raise will connect with the bottom of a water filled shaft. The wolframite-type ore will be taken from the shaft workings through the new opening.

★**Kaiser's Mead** aluminum reduction plant is ahead of schedule in the construction of its $7-million fluorine-fume control system. Officials of Kaiser Engineers reported the system would be three-fourths complete by mid-September. Six of the eight potlines were hooded, and the company planned to complete the project before the end of 1953 if equipment is available.

★**Consolidated Mines & Smelting Co. Ltd.** is doing assessment work on its own mining claims on both sides of the San Poil River, according to Hugh Brown, president. It is spending about $6,000 in development work this season at the Silver Ridge property west of Kellar. Values are in gold, silver, copper, lead and molybdenum.

★**New contract agreements** between

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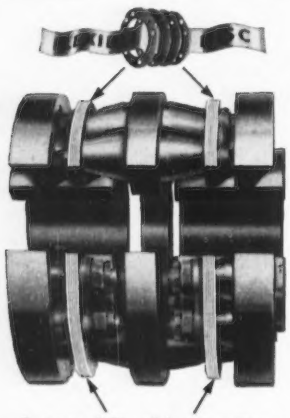

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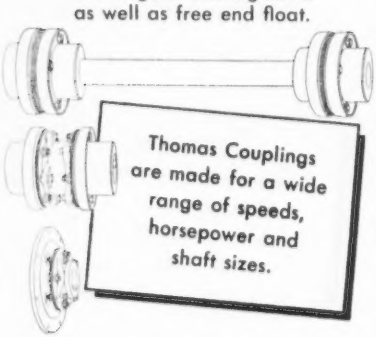

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Washington *(Continued)*

mine operators in northeastern Washington and the International Union of Mine, Mill & Smelter Workers were completed in August, giving about 230 workers wage increases of 8½¢ an hour. The increases are retroactive to February 1. The agreements are for two years subject to reopening June 30, 1954. The agreements were reached in separate negotiations with Pend Oreille Mines & Metals Co., and American Zinc, Lead & Smelting Co.

★**CIO Steelworkers** have signed a one-year contract with the American Smelting & Refining Co. covering 45 men employed at the Van Stone mill near Northport.

Ott Orr, the union's international representative in Spokane, said the contract calls for a wage increase of 5c an hour across the board. An additional 2½c goes for hospitalization insurance. Contract provides for six paid holidays annually. The Van Stone mill processes lead and zinc.

★**Northport (Wash.) Operating Co.** has exercised an eight-year option on lease to buy six patented and two unpatented claims in northeastern Stevens County. The Northport group paid $30,000 for the property to the Frisco Standard Mining Co.

★**Two northeastern** Washington mining firms have agreed to 8½c an hour wage increases for 230 members of the International Union of Mine, Mill & Smelter workers in the Metaline district.

Pend Oreille Mines & Metals, and American Zinc, operators of the Grandview mine, signed new two-year contracts subject to reopening June 30, 1954. The wage increases are retroactive to Feb. 1 of this year.

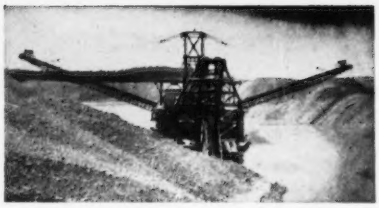
★Members of the International Union of Mine, Mill & Smelter Workers employed by the Tacoma Smelter at Tacoma, Wash., receive an increase of 8½¢ an hour under a two-year contract concluded with management.

IN CANADA

ONTARIO

★**Hogarth open pit mine** on the Steep Rock Range was formally opened in September with ceremonies at Steep Rock and at Port Arthur. To mark the fact that the mine is in regular production, a first shipment was made to Port Arthur of 7,500 tons of high-grade iron ore, divided between lump ore for open-hearth use and blast furnace ore.

In North American mining tradition, the first car of the first train carried an evergreen tree. The mine was named after Major Gen. Donald M. Hogarth, Steep Rock's original president who continued in that post



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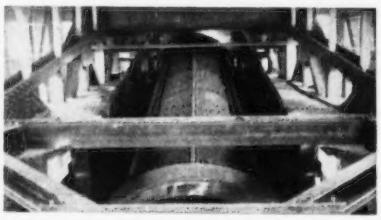

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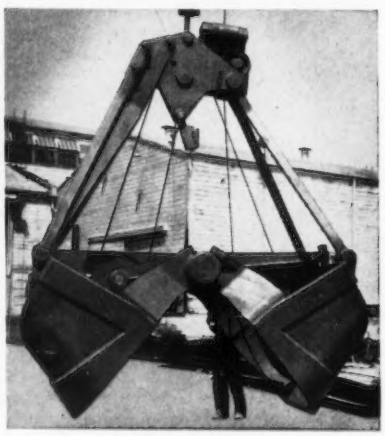

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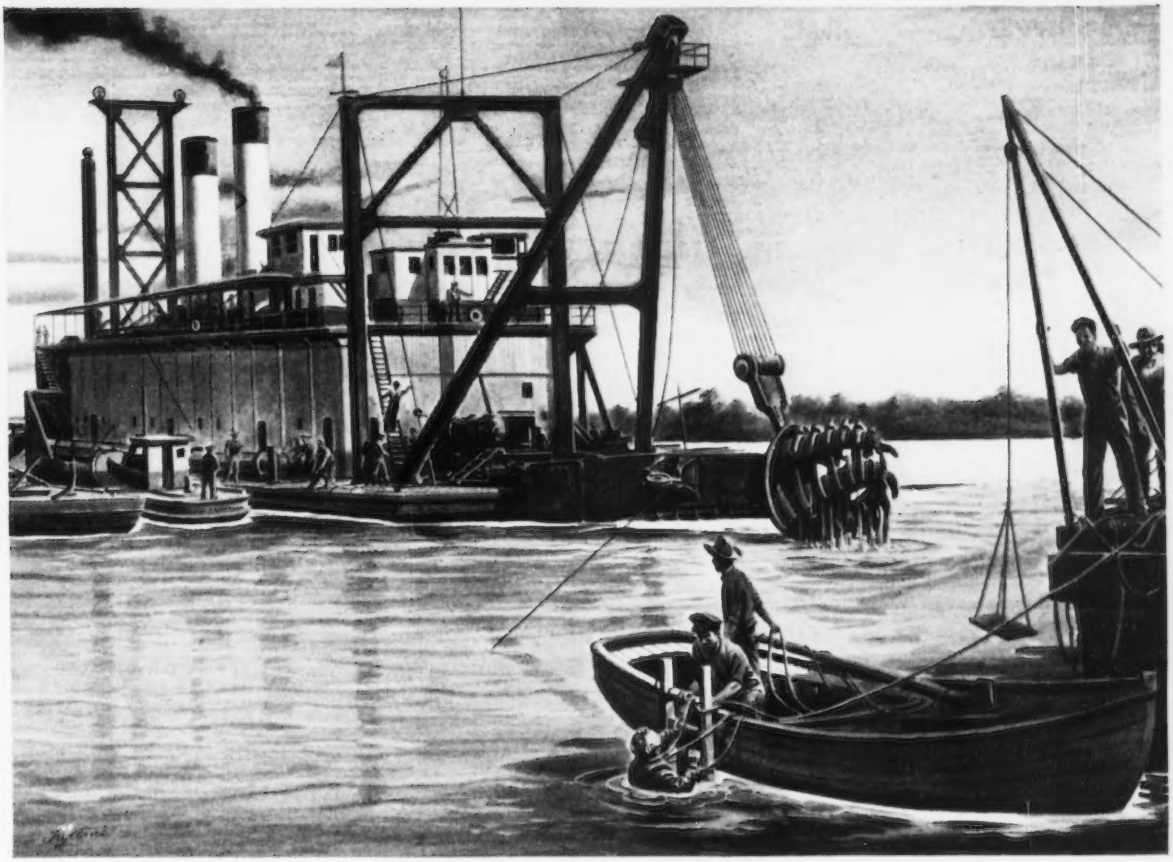

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Ontario *(Continued)*

until his death in 1950. His wife took part in the ceremonies. M. S. Fotheringham is president of Steep Rock Iron Mines Ltd.

Hogarth mine is the second open-pit operation at Steep Rock. Previous to this season, Steep Rock's Errington open pit yielded more than eight million tons of iron ore. After 1953, it will be superseded by the new Errington underground mine from which small tonnages of development ore already are coming in limited amounts.

The new Hogarth mine is designed to produce 2-2½ million tons of high-grade ore annually, depending on dimensions of the orebody when fully uncovered. Indicated dimensions are 3,500 ft. by 350 ft. This was the original discovery zone which started the Steep Rock development. Its existence was revealed in 1938 by drilling from the ice.

★**Exploration** has begun on the 1,200 acre Grand Chibougamau Mines Ltd. property adjoining the west and south boundaries of Preston East Dome's Pecors Lake ground in the new Algoma uranium mining area of the Sault Ste. Marie-Sudbury Mining Division of Northern Ontario.

★**An additional overall lift** in ore tonnage and in grade resulting from current deep hole drilling to date on the copper-gold orebody of Anglo Rouyn Mines Ltd. is reported by A. B. Ferguson, resident manager of Technical Mine Consultants Ltd., who are directing operations.

★**A good increase** in ore reserves was recorded by New Dickenson Mines in the first half of 1953, calculations at the end of June showing 316,000 tons compared with 275,000 at the start of the year. Grade stayed close to the half-ounce level. This growing young gold mine (Red Lake area) has increased its daily milling rate to 400 tons.

★**Conecho Mines Ltd.** reports initial exploration activities underway on its 1,400 acre property flanking the east boundary of the Emerald Glacier ground east of the Preston East Dome Quirke Lake acreage.

★**Algom Uranium Mines, Ltd.,** reported that latest diamond drilling assay results from its 166 claim Quirke Lake operation indicate continued intersections of the ore zone structure as drilling proceeds east on strike. The Algom corporation was formed to develop large interests held jointly by Preston East Dome Mines, Ltd., and Joseph H. Hirshhorn & Associates in the Algoma uranium mining area of northern Ontario.

★**Peach Uranium & Metal Mining Ltd.,** Toronto, speaking of its Discovery property, reported that deep hole drilling has indicated a 200 ft. extension of slope depth to previously indicated ore.

BRITISH COLUMBIA

★**New Arlington Mines Ltd.** has opened its new 100-ton mill near Salmo. The Arlington mine has a record of 50 years of gold production. New company was formed in 1951 and was converted to a public company last year. During the years of operation the mine has produced 47,800 oz. gold and 113,000 oz. silver from 24,500 tons grading 1.936 oz. gold and 4.62 oz. silver per ton. Considerable quantities of lead and zinc were recovered. A stockpile of 125,000 tons of broken ore valued at $875,000 will provide initial mill feed in the current operation.

★**Diamond drilling** is under way at the tungsten and gold-silver property of Deer Horn Mines Ltd. in the Kitimat area. This was announced by R. Macrae, resident manager of Technical Mine Consultants Ltd., which has worked out a major program of exploration and underground development work for the respective orebodies. A large complete mining plant has been purchased and is being delivered to the property, Macrae said. Construction of the permanent base camp and road continues.

★**Production at** Sheep Creek Gold Mines Ltd.'s Mineral King mine near Invermere in Golden mining division

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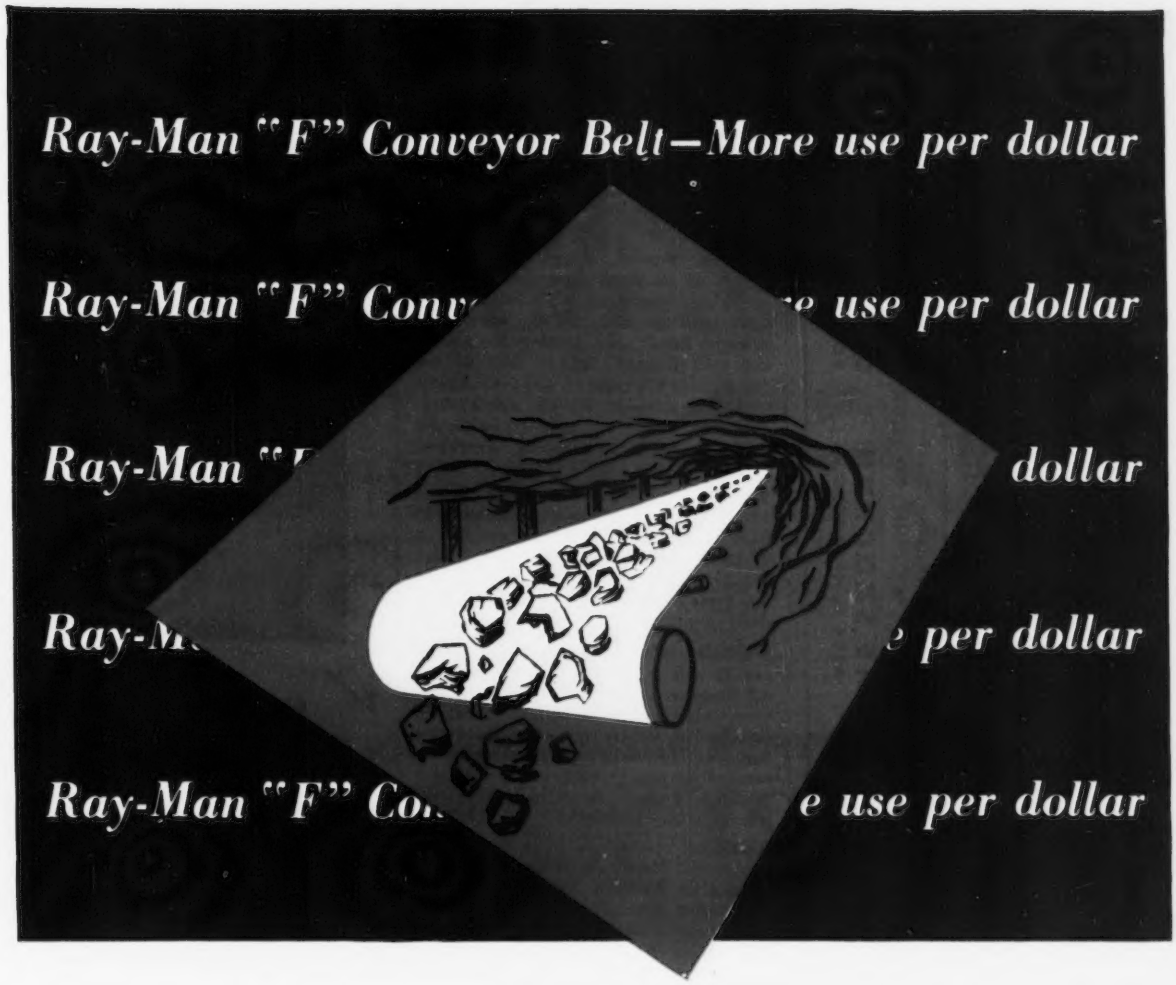
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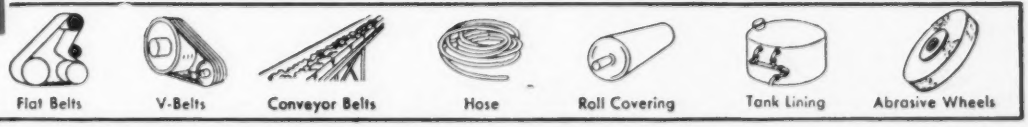

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British Columbia *(Continued)*

is scheduled to begin in January of next year. Mill output is expected to be 400 tons daily. Indicated ore reserves reportedly are 325,000 tons of 1.4 oz. silver per ton, 2.1 lead and 5.2% zinc. Sheep Creek reports a net loss of $107,972 during the year ended May 31, compared with a net profit of $51,254 the previous year.

★**Giant Mascot Mines Ltd.**, operating at Spillimacheen, reports an operating profit of $272,205 for the first nine months of the company's present fiscal year. During the period the mill treated 122,511 tons of ore for a daily average of 450 tons. Costs, including mining, milling, administration and shutdown of the company's gold property at Hedley averaged $3.74 per ton.

★**Western Tungsten Copper Mines Ltd.**'s Red Rose tungsten operation at Skeena Crossing set a record for a 24-hour period Aug. 13 when it milled 171 tons. The mine was expected to set a record during the month with a daily average of 155 tons.

★**Estella Mines Ltd.** reports discovery of a new high grade gold-cobalt-uranium ore zone at its Little Gem mine near Little Gun Lake in the Bridge River area. The discovery was made in surface prospecting being carried on concurrently with diamond drilling under direction of Evan Harris, mine manager.

★**Drilling operations** have started at the Sproat Mountain property at Revelstoke of Western Asbestos and Development Ltd. The company plans to drill cross-sections in the serpentine belt which has been well outlined at its southern end and traced several thousand ft. to the north. The serpentine has been found to contain slip-fibre, increasing the overall grade length and percentage of fibre.

★**Output** of Placer Development Co.'s mill at the Canadian Exploration's Jersey lead-zinc development was boosted 65% during the second quarter of 1953 ended June 30. The mill handled 158,774 tons, with a reported average grade of 2.03% zinc and 4.67% lead for a production of 16,122 tons of concentrates. The new underground crushing station with conveyor system to the mill went into operation June 20.

★**Construction of the** Kitimat-Kemano smelter project is proceeding satisfactorily, according to the half-year report issued by Aluminum Co. of Canada. The 10-mi. power tunnel through the coastal mountains to Kemano is 80% complete and tunnelers expect to make the junction from opposite directions on schedule in October. Installation of turbines and generators in the underground Kemano powerhouse has started, smelter construction at Kitimat is well advanced and the 50-mi. mountain transmission system is being rushed for the target date next June. Completion date of

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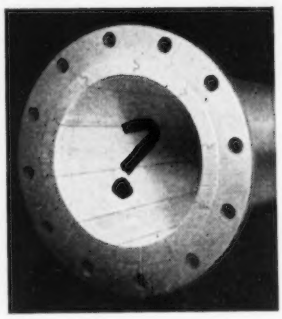

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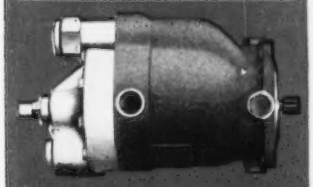

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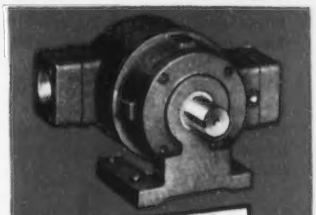

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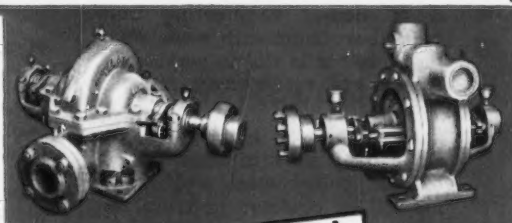

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British Columbia *(Continued)*

the new deepwater terminal at Kitimat, formerly set for Oct. 1, was advanced one week to permit unloading of the Norwegian ship Emu from England, which will inaugurate a new monthly direct freight service of Saguenay Terminals Ltd. between British ports and the aluminum smelter. The Emu has a load of fire brick for the new Alcan smelter, and a 67-ton British-built transformer for the Kemano power plant. Transformer will be unloaded at Vancouver and taken north by scow, according to present announced plans.

★**Deer Horn Mines Ltd.** has started development of its gold-silver-tungsten property on Whitesail Lake in the heart of the Alcan power project. Two gold-silver projects have been diamond drilled. The tungsten deposit was explored last year. The main vein of the gold-silver showing exceeds 2,580 ft. in length.

★**Opening of a** new high grade orebody at the Silver Tip mine has revived interest in the Stewart area which received a setback earlier this year with the closing of the Silbak-Premier mill. Mining officials in the Stewart area are watching the Silver Tip property closely.

Over a quarter century ago the first (and original) double-trunnion dump car was placed in service by Differential on the L & N. Sound engineering and careful workmanship were such that this car is still in service — still earning money for its owners.

Such details as hardened, self-lubricating pins in door mechanisms, rolled steel weldments instead of castings (making repairs easier when repairs are necessary)—these are examples of details that put Differential in the lead more than 25 years ago — and keep it there!

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SINCE 1915 — PIONEERS IN HAULAGE EQUIPMENT

NEW BRUNSWICK

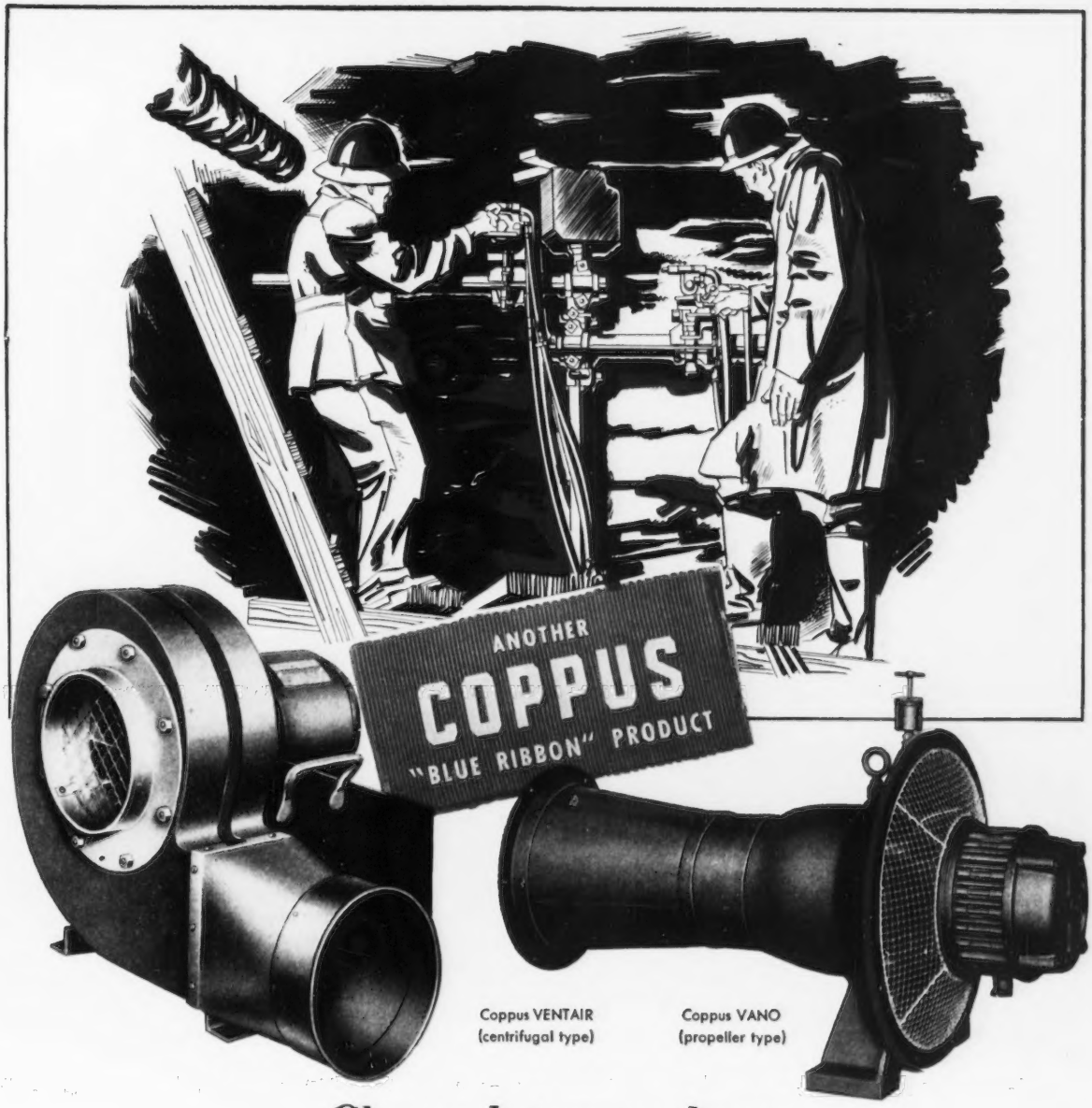
★**Plans for exploitation** of the new major zinc-lead orebodies in New Brunswick (*E&MJ*, May, 1953; page 101) were progressing rapidly at press time.

If present plans are executed, exploitation will pool much property and resources of three companies. These are the Leadridge Mining Co., Ltd., wholly owned by the St. Joseph Lead Co.; Brunswick Mining & Smelting Corp., and Anacon Lead Mines, Ltd. M. J. Boylen, who is credited with discovering and proving the new orebodies, is president of the Brunswick and Anacon firms.

There's no question now that New Brunswick is headed for big things as a mining province, though less than a year has elapsed since the first drill chewed into ore last fall at the Brunswick Mining and Smelting property. Three major orebodies are now indicated in the widespread Bathurst camp, and it doesn't take a great deal of optimism to foresee the day when 100 million tons of ore will have been recorded in the log books. Present indications are that the first milling plant could be a 10,000-ton project, a joint Brunswick-Anacon-Leadridge operation.

Latest property to show ore is that of New Larder "U" Island Mines. After months of disappointing results the drilling has come through in fine style with indications of a major deposit. Two holes 1,200 ft. apart showed good intersections; the north hole returned 86 ft. averaging 9.57% zinc, 2.66% lead, and 2.88 oz. silver per ton, while the south one showed 48 ft. that looked even higher in grade. The two holes were drilled deep in a zone that showed modest grade and width at shallower horizons (3.5% zinc, 0.9% lead, and 0.92 oz. silver across 13 ft. for the 1,300-ft. length). Full significance won't be known till considerably more work is done, but it is apparent that a major orebody has been found. It is wide open to both north and south.

The other two big ones are those of Brunswick and Anacon-Leadridge. The latter, discovered early this summer, has been drilled to the point where it shows 35,000 tons per vertical



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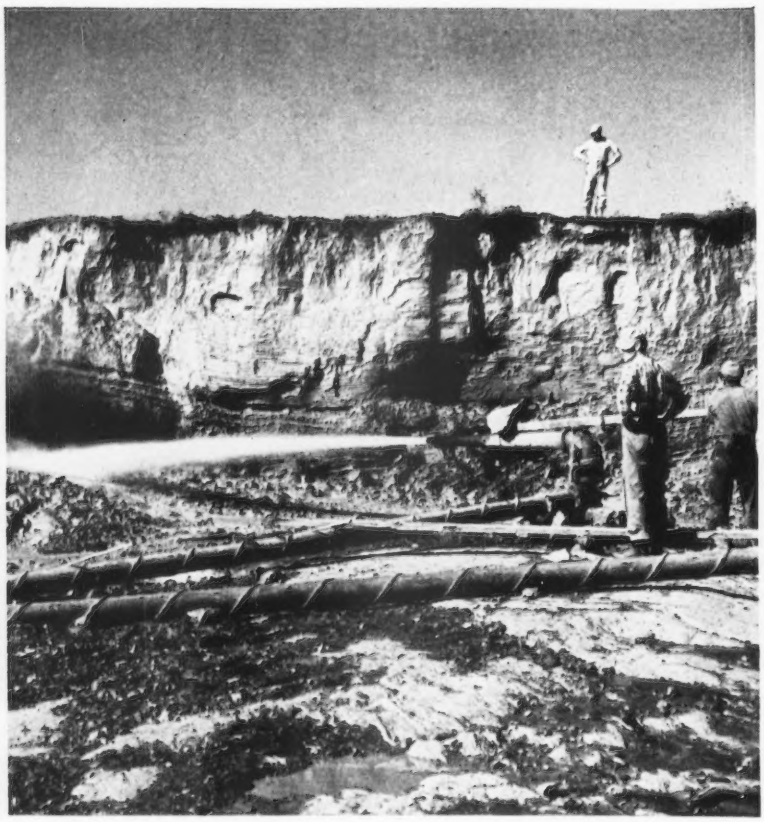

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New Brunswick *(Continued)*

ft. averaging 5.4% zinc, 1.72% lead, 0.64% copper, and 2.0 oz. silver per ton, with deepest drilling at 500 ft. The grade is similar to that of Brunswick, and tonnage appears to be somewhat larger. The deposit is jointly owned (40% each) by Anacon Lead Mines and Leadridge Mining Co., wholly-owned subsidiary of St. Joseph Lead Co.

Some distance north of the Bathurst area, Keymet Mines is slated to become a lead-zinc producer next year. It will be New Brunswick's first base metal mine. A mill is being built with designed capacity of 150-200 tons per day.

★Half-yearly production estimates of D.B.S. indicate that Canadian mineral output in 1953 may again top all records. New high marks are sure for iron ore, zinc, petroleum, natural gas, and cement, while increases over 1952 levels will be shown by half-a-dozen others. Only four of the 16 leading minerals in the list showed declines in the opening half year.

★**Estella Mines Ltd.** of Vancouver has been advised that five anomalies have been located on the company's holdings north of Anacon Lead Mines Ltd.'s Leadridge copper-lead-zinc property near Bathurst. Two have been traced for more than 800 ft., another for an indicated length of 400 ft.

QUEBEC

★**Start of production** for Opemiska Copper Mines (Quebec) Ltd. is now scheduled for December. The mill, with rated capacity between 300 and 400 tons daily, is just about completed. The mine, slated to be Chibougamau's first producer, has a comfortable ore reserve of just over a million tons averaging 4.82% copper, 0.068 oz. gold, and about one oz. silver per ton. Gross value at current prices is slightly more than $30 per ton.

★**Thanks to its good sales contract** (175,000 tons of zinc concentrates at 17.5¢ per lb. of contained metal) Barvue Mines is making good profits and is well started on debt reduction. The big mill is grinding 5,200 tons daily and turning out 6,000 tons of concentrates per month. In the first seven months of 1953 production had a net recoverable value of $2.9 million with operating profits of $1.9 million.

★**Vulcaan interests** of Rotterdam are in Canada studying properties of Fenimore Iron Mines Ltd. at Ungava Bay in north Quebec. The Vulcaan group several months ago was appointed European representatives of Fenimore to develop markets abroad and to provide equipment in Quebec for iron ore production and transportation.

If the Vulcaan technical mission determines that ore on the Ungava

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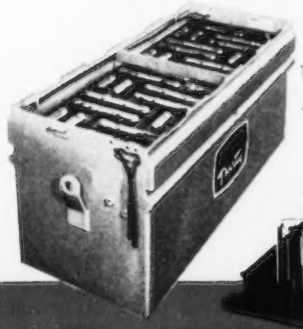

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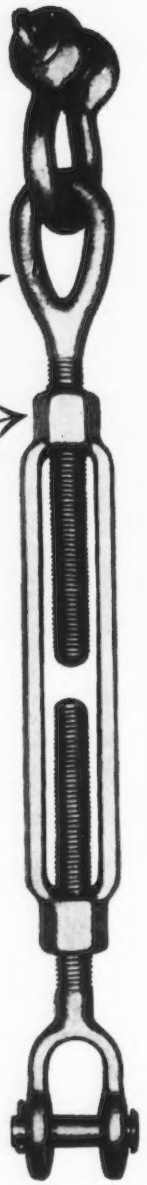

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Quebec *(Continued)*

Bay property meets requirements, the possibility looms that Dutch and West German interests may make a substantial investment. Such investment would involve one of the largest "barter" arrangements in recent years among European and North American interests.

★**Full scale exploration** has been launched by Panet Metals Corp. on its base metal prospect four miles southeast of Eastern Metals in Montmagny Co. Two zinc-lead-copper zones have been located, and surface drilling is being started along with extensive geophysical work.

★**New Metalore Mining Co.** is diamond drilling its 69-claim base metal property in Perron and Desmeloizes Twps., Normetal area. The work is being concentrated on the southern section of the group where a geophysical survey gave encouraging indications.

★**East Sullivan Mines,** zinc-copper giant of the Bourlamaque country, has been getting good results in the first probing done at depth following completion of shaft-deepening to 3,000 ft. Flat drilling on the 2,850-ft. level has located typical ore in the downward extension of the "J" zone. The intersection was 400 ft. below any ground previously tested in this area. It will be some months before the showing is opened, as several hundred ft. of crosscutting will be required; and the company has lots of time in which to establish the six new levels made possible by shaft deepening.

In the meantime, the mill is right up to its 2,500-ton capacity and is maintaining profitable production despite low zinc prices.

★**Bourlamaque's other** base metal mine, Golden Manitou, also has been getting encouragement in depth work. First drifting on the new orebody located by drilling on the bottom (2,330-ft.) level last spring has shown results right up to expectations, with grade of 8.8 oz. silver, 8.1% zinc, 1.51% lead, and 0.02 oz. gold per ton across width of 13.5 ft. Length at latest report was better than 100 ft. with at least 350 ft. additional indicated by the drilling.

★**Noranda and Macdonald Mines** have reached agreement after lengthy negotiations on production plans for a zinc-pyrite orebody formerly leased by Noranda.

Under the agreement, Macdonald Mines has incorporated a new company—West Macdonald Mines Ltd.—which has acquired plant, equipment and some 940 acres.

In addition, Macdonald has agreed to sell 460,000 of the 1-million shares in West Macdonald to Noranda. Noranda, in turn, is lending funds to equip West Macdonald and bring it to a minimum production of 1,500 tons daily. The loan, estimated at $4.5-million, is interest free.

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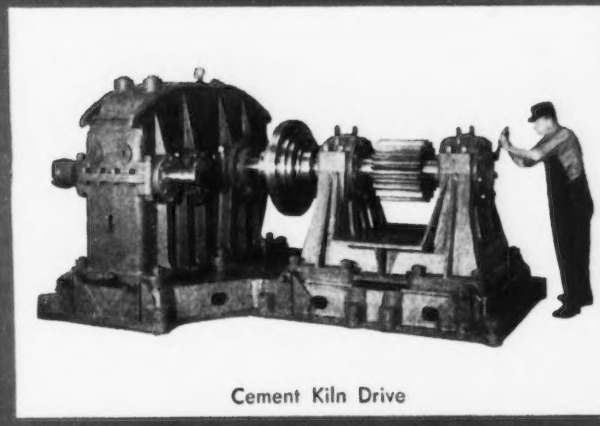

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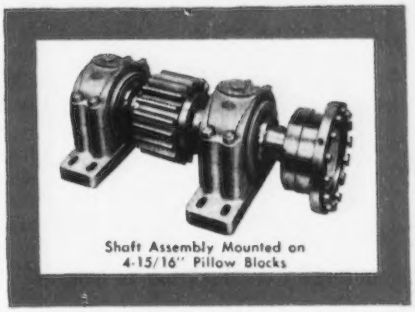

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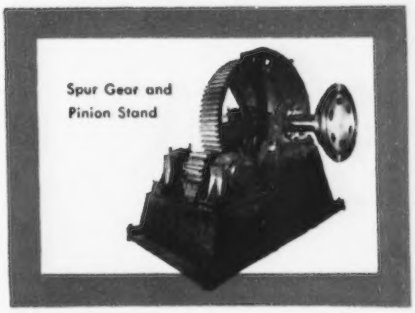

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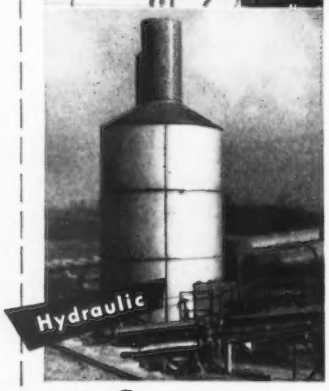

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Quebec *(Continued)*

It is expected that the mine will be in production within two years. Work starts immediately. Noranda has a five-year renewable management contract.

★**Quebec Copper Corp.** has arranged $1-million loan to build a mill of more than 500 tons daily capacity. The funds are to be borrowed from East Sullivan Mines and Sullivan Consolidated Mines. Copper property is near Eastman.

SASKATCHEWAN

★**Frobisher Ltd.** has assumed control of exploration and development of Beaverlodge Uranium Mines property in the Beaverlodge Lake area, taking up two options totaling 75,000 shares of a deal which over 15 months could yield Beaverlodge nearly $2 million if carried to its conclusion. According to Beaverlodge President Donald F. Farris, the agreement with Frobisher was undertaken for mining and geological reasons rather than financial. A crew of 17 geologists and prospectors under Frobisher management were on the Beaverlodge properties.

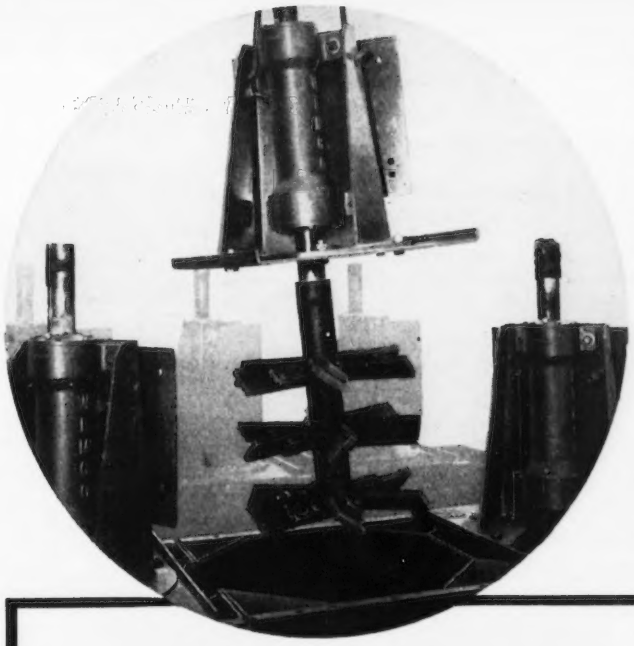
★**A long zone of radioactivity** has been discovered on the Athabasca property of Barbenor Malartic Mines Ltd., adjoining Athabasca Uranium in the Beaverlodge section. Readings indicate an average grade of .20%, $29 gross per ton, can be expected if drill cores confirm the surface findings. The zone has been traced for at least 400 ft. along a cliff, and could run another 1500 ft.

★**Great Northern Uranium Exploration Co. Ltd.** has been incorporated in B. C. to search for and develop uranium properties in Saskatchewan. The company now controls 17 groups embracing 180 chains within a radius of 15 mi. from the Eldorado mill in the Beaverlodge Lake area. The company is following a policy of farming out certain of its properties to operating companies.

YUKON

★**An orebody** rich in nickel has been located northwest of Whitehorse in mountainous country. It is reported that the very rich ore assays an average of 3.2% nickel, 2.2% copper, and 0.14% cobalt with small amounts of platinum and other rare minerals.

★**Hudson Bay Mining & Smelting Co. Ltd.**, according to R. H. Shanning, president, has staked or optioned two properties of interest in the Yukon. One is a silver-lead-zinc and the other a nickel-copper deposit. Diamond drilling on the former, the Tom Claims on Canol Road, during 1952 developed 9 million tons and the work was to continue this season. The latter, the Well-



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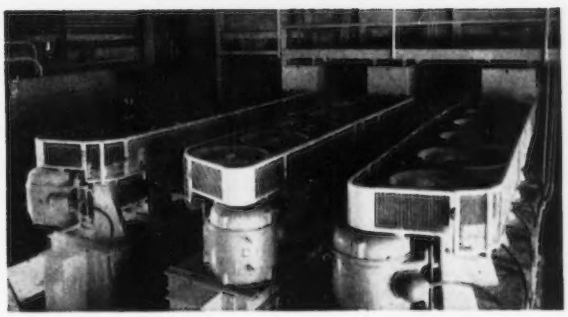

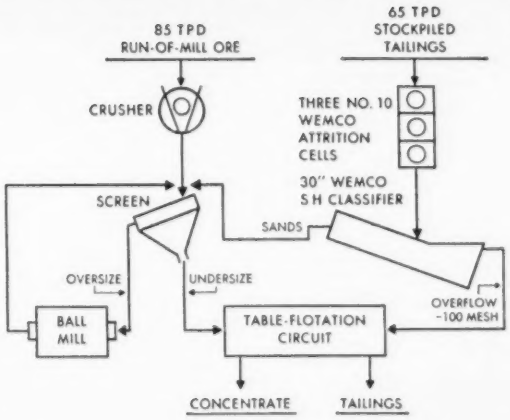

RETREATMENT OF STOCKPILED TAILINGS

On this tungsten application note that use of Wemco Attrition Machines makes it possible to feed former tailings into the same flotation circuit as new run-of-mine ore, resulting in considerable added profit to this producer in terms of greater units of tungsten recovered.

Increased recoveries of critical tungsten minerals are now being made from materials rejected as tailings by various milling processes previously used at a Nevada tungsten mine (name on request).

By using Wemco Attrition Machines together with flotation, it is now possible to recover 92% of the tungsten values in this former reject material. Before addition of the attrition machines, flotation alone recovered only 64% of the tungsten. The greatly increased recovery after attritioning is due to removal of a stubborn oxide coating on the mineral particle surfaces, caused by weathering of the stockpiled material.

75% increased mill tonnage was made possible with the installation of Wemco Attrition Machines to treat 65 tons per day of former rejects.

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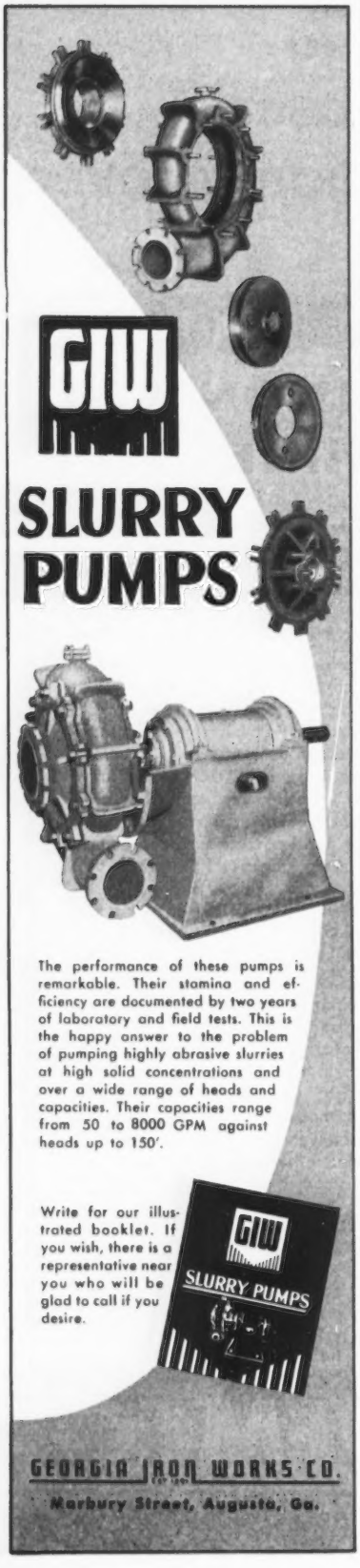
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Yukon *(Continued)*

green holdings in the Uaune Lake District, about 12 by 3 mi. in area, is said to be well mineralized. Beside the nickel-copper, it is said to have showings of gold-platinum-palladium and cobalt.

★**Frobisher Ltd.** may spend from $500 million to $2 billion on a power and mineral development in the Yukon, it is reported. Thayer Lindsley, president of Frobisher, at an annual meeting in July, expressed the hope of having within a year or less a full picture of potential water resources in the Yukon. It has been reported that the company's plans include a dam on the north end of Lake Labarge in southern Yukon, creation of a lake 100 to 200 ft. deep, construction of 3 hydroelectric plants near Kluane, Chilkoot Pass and Teslin, with a combined potential of 5 million horsepower, erection of smelters and creation of a deep sea port on Taku River, or near Haines, both in British Columbia.

MANITOBA

★**Rix-Athabasca Uranium Mines Ltd.** reported that at Beaverlodge the 350 ft. crosscut driven north from the west end of the Smitty hanging wall orebody on the second level west has entered the footwall ore where expected. F. R. Joubin, managing director, said that first assay results from this sector were very promising.

IN LATIN AMERICA

VENEZUELA

★**The big show** in Venezuela is staged deep in the tropical and unexplored plains of the Guayana, drained by the sluggish and swampy Orinoco. Five years ago, solitary prospectors, fugitives and an occasional adventurer visited the region; now scarcely a week passes that a plane-load of industrialists fails to drop in for a look. Maracaibo with its lakeful of derricks is no longer the number one attraction.

This week another delegation from United States Steel has flown in to look at the tremendous task of dredging the Orinoco, laying a highway from shiny, new Puerto Ordaz to Cerro Bolivar and to run the rich, red dust of the iron mountain through their fingers. Headed by R. M. Lloyd, vice president of U. S. Steel in charge of raw materials, the group was composed of: C. D. King, assistant vice president; J. M. Stapleton, assistant vice president in the field of high-stacked furnaces; J. J. Golden, assist-

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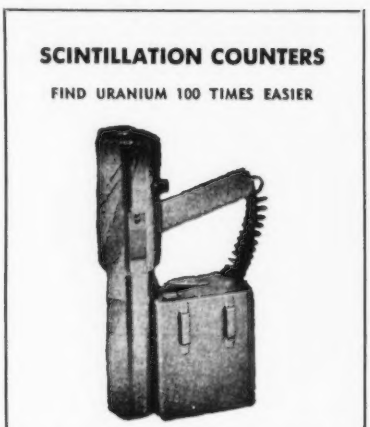
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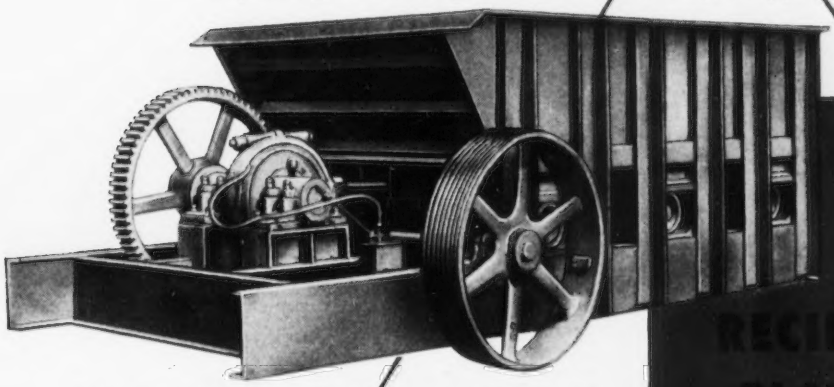

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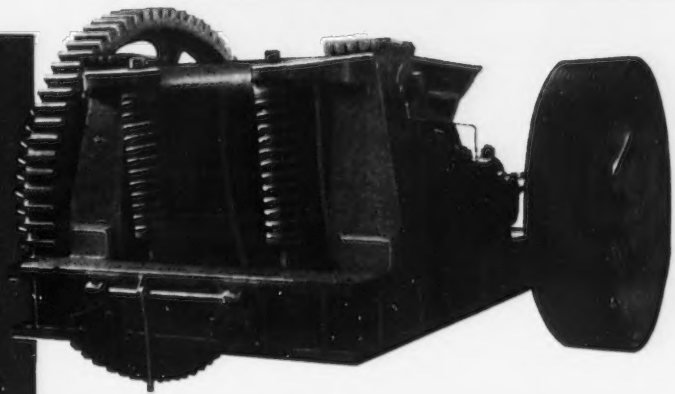

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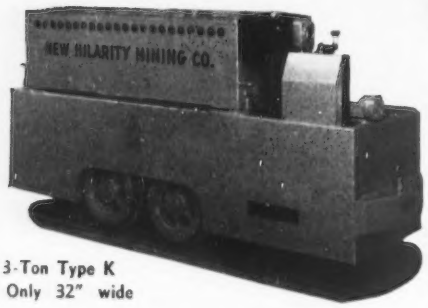

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Venezuela *(Continued)*

ant vice president in steel production; J. G. Greveling, second general superintendent of mines and quarries of the Tennessee Coal & Iron Division, and J. P. Muller, director of Supplies and Purchases of the Raw Materials Division of U. S. Steel.

Meanwhile, another plane brought in Harold E. Banks, president of MacDougall Co., to investigate the work his firm is doing in the big Orinoco Mining Company development. MacDougall has been contracted for installation of electronic cable (cintas electronicas) by which the iron will be transported from the mines to the railway U. S. Steel has built to transport it to Puerto Ordaz. The MacDougall installations are being made by 200 workers brought from the States and cost U. S. Steel $10,000,000. Banks estimated that they would be concluded by December of this year.

CHILE

★**CORFO (Chilean RFC)** reportedly has decided to build a sulphuric acid plant in the Antofagasta Province where oxide ores are plentiful and easy to leach.

The proposed plant is to have a capacity of 30 metric tons of 98% acid per day and will be of the contact type. Until now, acid for leaching the oxide ores in small plants in this region was obtained from a by-product of a dynamite factory in Calama. In Antofagasta are located also most of the brimstone plants which will produce sulphur for making the acid.

In another action, CORFO is bringing up-to-date the estimates and other preliminary work already done in connection with the erection of an electrolytic copper refinery to treat blister from the smelters of Paipote and Chagres. The work is being done in the case of the Chagres smelter just in case it begins operation again; it has been down since 1945.

CORFO reportedly plans also to build an electrolytic zinc refinery with a yearly capacity of 2,000 tons of metallic zinc.

★**Officials of** Ventures Consolidated Guayanas Mines Ltd., a subsidiary of Canadian Mining Corp., have arrived in Chile to examine the possibility of taking up some very large low-grade copper deposits found in the region which extends from the port of Arica to the Camaraones Canyon. The orebodies are near the sea and since this zone is a total desert, sea water will have to be used for beneficiating the ores.

★**The Chilean Government** has decided to re-open the San Martin nitrate deposit at Aguas Blancas, Antofagasta. Private owners are to be provided with the capital necessary to produce 25,000 metric tons yearly.

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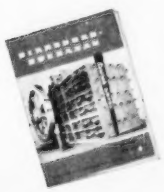

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Chile *(Continued)*

★**Braden Copper Co.** has won for the sixth consecutive year the annual safety award given annually by the Inter-American Safety Council of New York. The Braden Company competed in the class "A" competition for mining companies and which is reserved for those organizations that employ more than 5,000 workers. On this occasion the organization received also a special congratulation from W. T. Rogers, director of the Inter-American Safety Council.

★**Exploitation** in small scale of the iron mines known as Cerro Negro Norte and Cerro Negro Sur has been started by a mining company recently formed by American and Chilean capital. The mines are located near the Toledo railroad station on the branch line from Copiapó to the port of Caldera and the ores which assay over 60% iron will be exported to the United States.

★**Antofagasta Mining Association** has complained to the Governor of the Province about the lack of funds of the Mining Bank to pay promptly for the ores, concentrates and cement copper which the miners in this zone sell to it. The same complaint has been made by several other mining associations.

★**Because of** a sustained demand for high-grade iron ores, many individual miners and Chilean companies have been examining the possibility of exploiting some of the smaller high-grade iron deposits, up to 5 million tons, that exist in Chile. A certain amount of mining has already been done on some of these deposits, but the margin of profit is very small with the primitive methods of exploitation and loading employed at the ports.

MEXICO

★**Continental Mineral Co., S. A.,** is conducting development work at the El Canutillo group of claims in Sonora. During both World Wars, El Canutillo supplied small tonnages of high-grade molybdenite to the Allies.

Recent development indicates the possibility of enlarging the mine to a medium-size operation, according to Frederick Hauck, of Cincinnati, president of Continental Mineral Processing Corp. and of Continental Mineral Co., S. A. H. R. Herner, of Douglas, Ariz., is manager of Mexican operations.

Continental also owns the Verde group of claims and the Cobre Rico Mine near Cumpas, Sonora.

★**Antimony mining** in the once flourishing zone in El Zoyatal Municipality, Queretaro, was dealt a near-death blow by the Korean Armistice, the Federal Senatorial mining committee was told. Suspension of hos-

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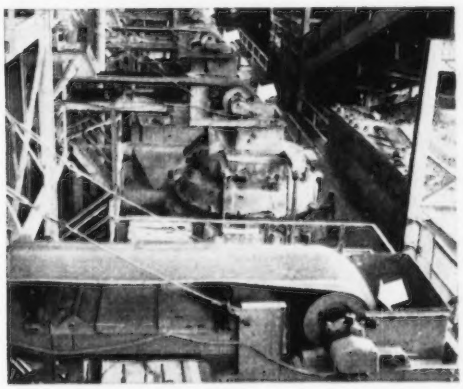

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Mexico *(Continued)*

tilities in Korea directly stopped the antimony mines of Pinal de Amoles, La Concha, El Santo Entierro, El Serrano, La Esmeralda, El Zoyatal and San Joaquin, throwing 1,500 miners out of employment. Owners of these mines, reportedly, are limiting themselves to marketing stocks on hand as they fear decreased demand and lower prices for antimony. The committee seeks to prevent the closure of other mines because of the armistice.

★**Manganese is enjoying** a boomlet in the Etla and Nochixtlan zones, Oaxaca. Thirty-seven applications for manganese exploitation concessions were filed at the Ministry of National Economy's mining agency in Oaxaca City during July—23 by the Cia. Minera Totocuno, S.A., and 14 by individuals.

The National Institute for the Investigation of Mineral Resources, Ing. Raul de la Peña, chairman, is checking a discovery reported by Ing. Alfonso Martinez Berges, prominent Oaxaca mining engineer, of germanium at a place near Oaxaca City that is being kept secret. The Institute is also examining reported uranium finds in Oaxaca, mostly in the southern part, near the Isthmus of Tehuantepec.

★**An upswing in work** of 24 lead and zinc mines in the Toliman Canyon zone, Nuevo Leon, is forecast by the Ministry of Communications and Public Works as a result of increased transportation facilities that will be afforded by the 12-mile road it is completing to Zimapan on the Mexico City-Laredo, Tex., highway. The mining companies and the State Government are cooperating in defraying costs of the road.

★**Mexico's pioneer mining cooperative,** the Dos Carlos, Pachuca, Hidalgo, has suspended indefinitely because of progressively worsening finances which provoked a weekly deficit of some 12,000 pesos ($1,380) despite frequent money contributions by the Federal and State Governments. Both Governments are helping the 243 members to find employment. The only work now being done in Dos Carlos' mines is pumping by contractors who obtained permission to work the properties on their own account and the Cia. Minera Real del Monte y Pachuca, S.A., to protect its adjoining workings from flooding.

★**Mining operators** and the miners union are cooperating with the Labor Ministry in its national checkup on mining safety facilities and services. The Ministry seeks to prevent repetition of recent fatal accidents in mining.

★**Mining is doing so well** in the Galeana District, Nuevo Leon, that most jobless miners in neighboring San Luis Potosi have found work there, announced the Ministry of National

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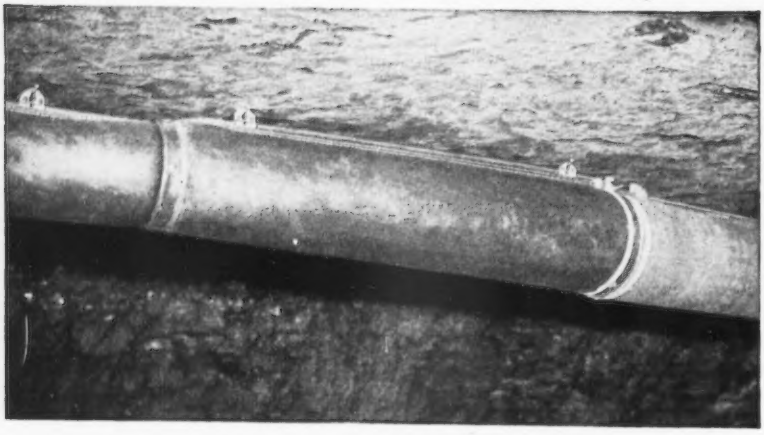

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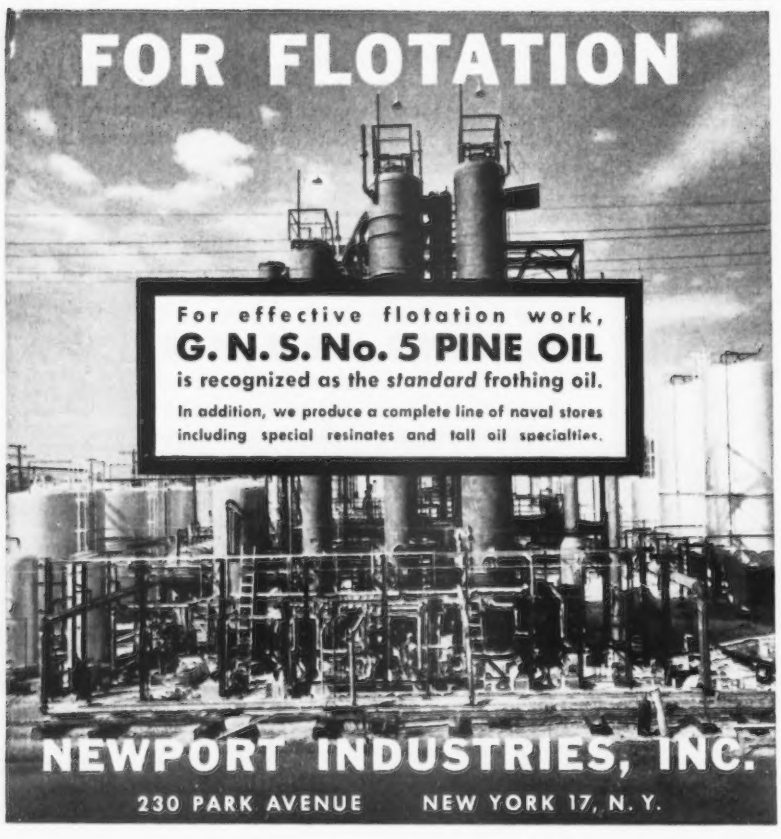
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Mexico *(Continued)*

Economy. The Galeana activity is spearheaded by exploitation of new gold, silver and lead deposits at El Palmito, owned by Arcadio Sanchez Rosas and Jose Amaro Flores, and a gold mine near the town of Galeana that Melesio Sanchez Almaguer owns.

★**Mexico** may find herself producing enough sulphur to be able to cease importing sulphur as early as October because of upped production by the plant Petroleos Mexicanos (Pemex), the official oil company, operates in the Poza Rica oil fields, Vera Cruz. Output at this plant is approaching 200 tons daily, and marked advancement of sulphur works on the Isthmus of Tehauntepec, said Ing. Gustavo P. Serrano, president of the Mining Chamber. He indicated that next year Mexico should be producing sulphur enough not only for all her own needs but for a considerable amount of exporting as well.

BRAZIL

★**Existence of cobalt** in the São João Del Rey area of Minas Gerais State has been reported here, stimulated possibly by world press reports of a cobalt "C" bomb, surpassing the "H" bomb. Unconfirmed reports state that the Mineral Production Department of the Ministry of Agriculture in that locality has already received enough material to install a plant to produce concentrates of radioactive minerals. The National Research Council, however, has not yet received any communication as to the existence of cobalt in that area.

COLOMBIA

★**By decree** the National Government has granted free trade for gold and suppressed the export duty on this metal. Exporters have to deposit foreign exchange obtained from such exports with a local bank in Colombia but they may trade such foreign exchange freely. All expenses involved in mining gold have to be made from such income in foreign exchange. The same decree established a tax of Col. $2.50 (US $1.00) per oz. of gold produced. It is hoped that this new measure will increase gold output in Colombia.

In June 1953 production fell further from 31.671 ounces in May to 31.419 oz. and 39.947 oz. in January.

★**After four years** of complete closing down of the emerald production in the government-owned mines of Muzo, it has now been decided to open these mines again. Since the change in government occurred on June 13, 1953, guerilla activities in the area of Muzo have been suspended. They were the main reason for the closing of the mines. Accord-

Underwater operation holds no peril for these Hazacord cables. Skid mounted junction box contains four 400 amp. circuit breakers . . . single cable leads from transformer bank; four branch circuits go to the control house near the shovel (below). The 500 horsepower motor which operates the pit-pump used for pumping the phosphate-bearing matrix to the washer also gets its power through Hazacords.

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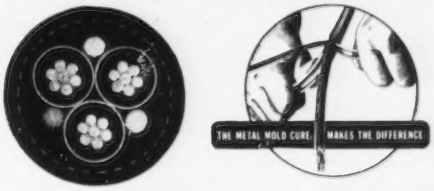

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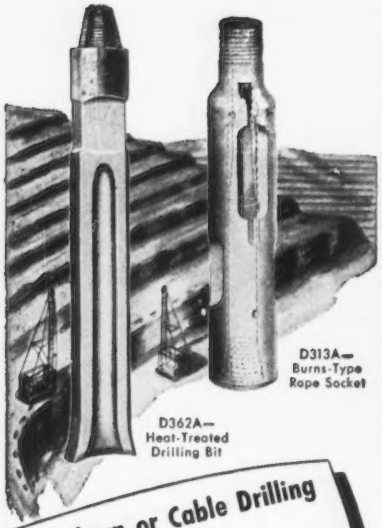

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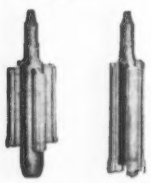

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Columbia *(Continued)*

ing to information from Banco de la República the stock in emeralds held by the bank has fallen very low recently.

IN AUSTRALIA

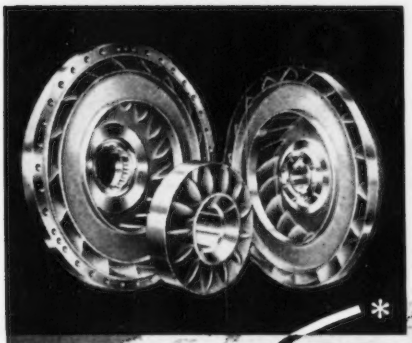
★**Falling world prices** of copper have not helped the Australian producers whose costs of production are high and mounting still further as a result of wage hikes. Considerable quantities of low grade ore are being exploited and the falling demand means more attention to overseas markets. Shipments have already been effected to the United States and other areas and all imports of copper have been stopped. The producers have asked for subsidies on copper to enable some of them to stay in business.

★**The search** for additional deposits of uranium seems to have met again with success although reliable geological circles are warning that the results of two recent discoveries will not be verified for a few months. The main recent discovery is hailed by some as probably better than Rum Jungle fields. Excellent surface indications have been reported by Commonwealth geologists in an area about 230 mi. from Darwin in an area practically unknown to white men. Initial exploration was by specially equipped Dakota aircraft and a ground party has confirmed excellent results. The new field is situated far away from roads and some will have to be built before the wet season starts in the Northern Territory and before all work has to be stopped. Diamond drilling is expected to start in the near future. In the meantime at least one member of the Advisory Committee on Raw Materials to the U.S. Atomic Energy Commission has visited the new field, which is likely to be known as Coronation Field.

★**Another potential uranium field** is being extensively tested at Manton Dam, about 40 mi. south of Darwin. Surface indications are said to be encouraging.

★**Australian Federal Government** has shown signs of discouraging private prospectors for uranium in an area where they were previously supported by the Government. About 3500 sq. mi. are being searched by aircraft and ground parties are pegging all uranium finds, including many small ones where the economics of extraction would make exploitation impossible. The Government has also banned private prospectors, temporarily at least, in the very promising Edith River area, 180 miles south of Darwin.

However news was received that private companies are being formed to prospect for uranium in other areas of the Northern Territory. A substantial number of search parties is con-



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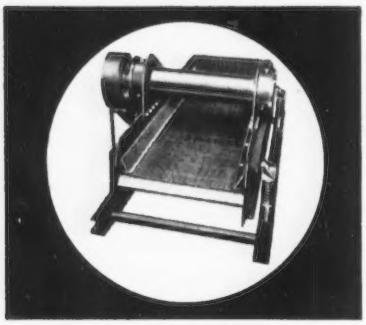

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BEE-ZEE SCREENS CAN BE FITTED TO ANY SCREENING EQUIPMENT

Australia *(Continued)*

centrating on the old copper mines.

★**Western Wolfram N.L.** is now treating 50 tons of ore a week for the production of one ton of concentrates. Capacity of the plant is 150 tons a week and preparations are being made to achieve this in the near future.

Pan values of one ounce to the ton have been reported by Merloo Gold Mines N.L. at its Enterprise mine in Northern Territory. On the 180 ft. level sampling by test holes indicates ore reserves with estimated pan values of 15 dwt. At the 230 ft. level, a winze started from the floor of the main stope in soft hematite. Crush formation on the southern fault zone gave pan values of over 1 oz. a ton.

IN AFRICA

★**A high borehole value** of 40.61 dwts. over 71 inches, equal to 2,883 inch-dwts., has been obtained in a conglomerate band containing some internal waste at a depth of 2,888 ft. in the southern portion of the lease area of Merriespruit G. M. in the Free State gold fields.

At 2,901 ft., another band yielded 303 inch-dwts. and at 2,930 ft. another band was intersected carrying relatively low values.

These results were termed remarkable for two reasons. First, this portion of the field had heretofore been regarded as being underlain by relatively low-grade deposits; second, there appears to be a possible correlation of this formation and the famous "Rainbow Reefs" found in the northern portion of the field where high values have been disclosed. Kennecott Copper has a substantial interest in this property.

★**Values and percentage payabilities** in new mines of the Free State continue to improve, according to progress reports for the second quarter. These reports add weight to the view that the eventual grade of the mines will be higher than the original encouraging drilling results suggested.

Among properties involved are Harmony G. M., Western Holdings, President Brand, Merriespruit G. M., President Steyn, Freddies North and Freddies South.

★**Net profit** of Nchanga Consolidated Copper Mines for the year ending March 31 amounted to more than $39-million, compared with $28-million for the previous 12 months. Ore reserves April 1 were estimated at more than 133 million tons with a total of 4.59% copper of which 2.53% is oxide.

★**Witwatersrand Gold Mining Co.**, one of the oldest gold mines in South Africa, is ceasing operations because high working costs make operation no longer profitable.

The old stager is to be left in

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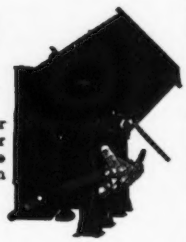

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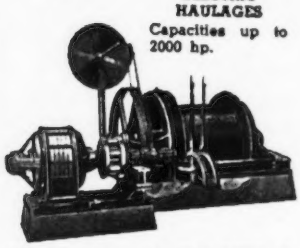

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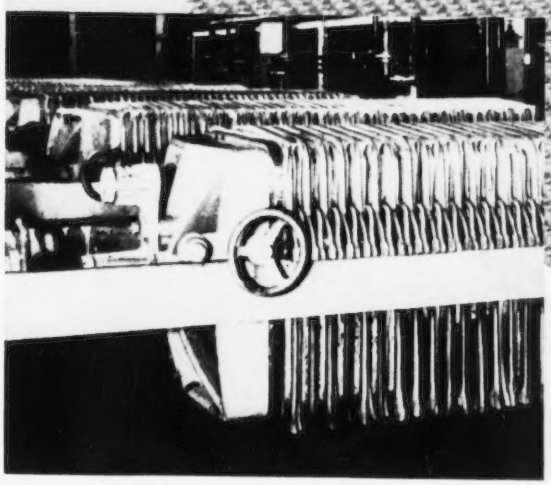

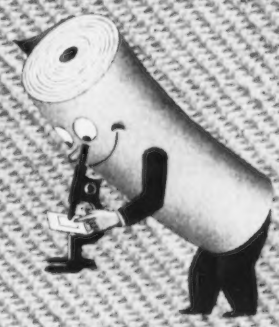

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"Every Little Bit Counts"

Africa *(Continued)*

such a condition that it could be reactivated without much re-equipment. Re-opening would depend, of course, on world gold price and mining costs. The mine began operation in 1896.

★**Southern Rhodesia's** small asbestos producers are appealing to the government for help. Unless their position improves, they will be forced to halt operations.

Producers are asking the government to set up a selling agency backed by the Department of Mines. In addition, they want the government to call to conference all producers who need aid in disposing of their output.

Many producers have sold no fiber over the past three or four months. In addition to the drop in world demand, the slump seems to be anchored in such factors as poor consumer contacts, excessive handling charges, the grading of Rhodesian fibers has not been uniform and the fact that on many occasions large tonnages have been placed on the market with excessive grit and dust.

★**Value of all minerals** produced in Northern Rhodesia in June, 1953, was £11,011,501 compared with £9,032,544 a month earlier and £7,405,633 in June, 1952.

In June, 1953, production of blister copper totaled 27,805 tons worth £7,281,988. Electrolytic copper output amounted to 12,193 tons valued at £3,264,556. Limestone production reached 23,987 tons (10,794), while sheet mica output totaled 1,707 lbs. with a value of £427.

★**Bancroft Mines, Ltd.,** has been incorporated in Northern Rhodesia with an authorized capital of £5,000,000, divided into 20-million shares of 5s. each. The disposition of the shares follows: British South Africa Co., 3,000,000; Rhokana Corp., 9,500,000; Rhodesian Anglo American, Ltd., 74,700; members of Rhokana, 3,570,300; members of Rhodesian Anglo American, 3,855,000.

The new mine has reserves of copper ore which have been proved by diamond drilling over a period of years to total approximately 80-million short tons with an average copper content of 3.6%, the company reports. It is proposed to develop and equip the mine to produce about 150,000 tons of ore a month, equivalent to 4,000 tons of copper. It is expected that production will commence in 1958.

★**South African Minister of Mines,** Johannes Viljoen, has stated that South Africa will produce "a very considerable tonnage" of uranium oxide yearly when its full production program is achieved.

Addressing a party of U. S. Congressmen and others on an overseas tour for the Congressional Committee on Atomic Energy, Mr. Viljoen said that 22 mines were in the production program. Three were already producing, another two were likely to start

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Africa *(Continued)*

before the end of the year and 16 more would probably enter production in 1954.

★**An important strike** of base minerals has been made in Namaqualand. The strike, which is in the pegmatite areas of Namaqualand, about 25 miles from Springbok, contains 4 reefs extending over about 18 square miles.

It is estimated that in the raw state, the ore will be worth about £100 per ton. There is a seam of high quality beryl and a rich reef of mica. The rest of the strike consists of ores of various minerals. One of the by-products will be titanium oxide.

IN EUROPE

GERMANY

★**Negotiations on copper** and copper ore deliveries by the Chilean Paipote Foundry to the Norddeutsche Affinerie Hamburg are expected to begin in mid-October, the West German economic news agency VWD, quoting informed sources, reports.

The Norddeutsche Affinerie intends to buy 13,000 tons of blister copper and 5,000 tons of copper ores next year, VWD said. They will only buy, however, if Chile is willing to make price concessions. Informed sources here believe that these will be made.

The German Government has postponed general trade negotiations with Chile, so that it can negotiate the copper deliveries which represent a principal part of the trade agreement, at the same time, VWD said.

BELGIUM

★**The Belgian company** "Vieille-Montagne" has been authorized to exploit zinc and lead mines in Fedj M'Kamene in Constantine (Algeria), according to an official announcement. This follows a request made by the company on May 19, 1950.

HUNGARY

★**A large deposit** of alabaster-fine gypsum reportedly has been found in northern Hungary near Rudabanya, 20 mi. north of Miskolc. This was said to be of great importance to the Hungarian cement industry because, until now, all gypsum had been imported from eastern Germany and Rumania. The discovery was made in May by geologists searching for iron ore.

The first shaft, 400 ft. deep, went through gypsum all the way after the first 17 ft., according to an official Hungarian government announcement made recently.

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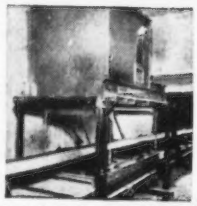
WHILE YOU CONVEY



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Building a loading dock for this operation was impractical, so the problem was solved economically by using a hose specially designed for the job by Pioneer laboratories. Despite the whipping and jerking, the sun and salt water, the hose is giving service far beyond what was expected. Many lengths have been in use *for over 20 years!*

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Europe *(Continued)*

Beneath the gypsum, at 2,000 ft., the first drills hit salt, it was added by a government official.

ENGLAND

★**A virgin deposit** of lead ore has been discovered below Riber Hillside, Matlock, Derbyshire. It is claimed that this is the most important find of the century in the Derbyshire lead-mining field.

Derbyshire Stone and the Johannesburg Consolidated Investment Co. began prospecting in 1949. When diamond drilling disclosed the presence of lead in a bed of limestone below Riber Hill, a new company was formed —the Matlock Lead Mines—to continue exploration.

AUSTRIA

★**Austrian aluminum** production in May, 1953 reached a record figure of 5,780 tons, bringing total output for the first five months of this year to 15,347 tons against 12,010 tons in the first five months of 1952.

★**Ore production** for the first half of 1953 showed generally a considerable increase over the same period of 1952. Details were as follows, in tons:

	First half 1953	First half 1952
Iron ore....	1,348,700	1,277,500
Lead/zinc ore	76,500	72,000
Copper ore..	80,400	61,000
Antimony ore	5,200	6,300

Meanwhile, the nationalized Donawitz combine of the Alpine Montan Union recorded a peak production of 225,660 metric tons or iron ore during June. This production is unsurpassed except for one month during 1944 when, under the Hitler regime's forced labor, without regard to cost or economy of production, it accounted for 230,000 metric tons.

IN SCANDINAVIA

NORWAY

★**Construction of Norway's** biggest aluminum plant at Sunndalsora, West Norway, is ahead of schedule, and it is expected that production will start next year. Output will be 40,000 tons a year at first, but may be increased to 50,000 tons later. The overall Norwegian production of aluminum is now about 50,000 tons a year, so that the new plant will almost double the national output.

Production at Sunndalsora will be in two large halls each about 1,600 feet long and holding altogether 264 furnaces. The plant is being built with the help of a United States loan, and under the terms of the loan, repayment will be made in the form of aluminum at the rate of about 8,000 tons a year. The plant is being built by a Government company which already operates an aluminum plant built after the war at Ardal, West Norway. The Sunndalsora plant will employ about 1,000 when production starts.

★**A new type** of magnetic separator for the mining industry has been developed by the Norwegian firm of A/S Thunes Mekaniske Vaerksted, in conjunction with a leading mining concern in the county, it is announced here.

Already in operation in various parts of the country, the new separator is used for dressing and extracting iron ore—either the wet or dry system—for the removal of undesired iron from other ores, etc. Iron ore concentrate leaves the separator containing over 70% solids and can be sent directly to secondary mills and filters, it is stated.

SWEDEN

★**Only 6,079,000 tons** of iron ore were shipped from the state owned Luosaavaara Kiiruna mines in Kiruna, North

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For minimum reaming costs combined with high efficiency in action, J. K. Smit Reamer Shells are the answer to your drilling problems.
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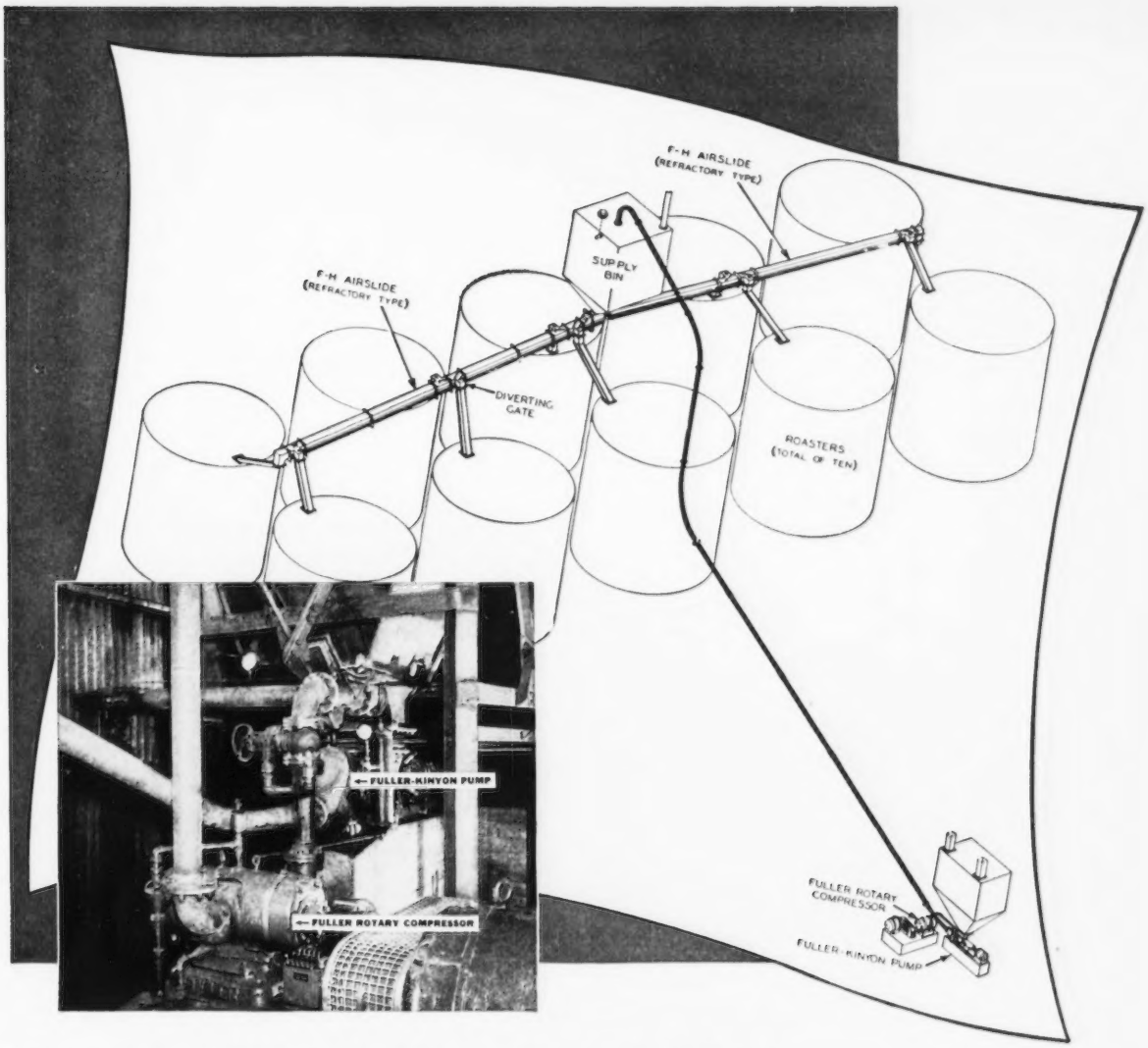

Conveying "Hot Stuff" at Noranda Mines--- with Fuller-Kinyon Pump and F-H Airslides

Problem: To convey hot flue dust from Cottrell precipitator collecting hoppers, and distribute uniformly to ten roasters, without dust or loss.

Solution: After long and careful study by both Noranda and Fuller engineers, it was decided to install a Fuller-Kinyon Conveying System as the most practical and efficient method of conveying from the precipitator to a supply bin. A Fuller-Kinyon Pump, with water-cooled seal, handles this flue dust at temperatures up to 800 deg. fahr., at rate of 25 tons an hour, in a highly satisfactory manner, through a conveying line of approximately 220 feet. From the supply bin, F-H Airslides, of the refractory type, convey and distribute the material to the roasters, with no dust or loss.

A Fuller Rotary Single-stage Compressor furnishes approximately 478 c.f.m. of air at 15-lb. pressure, to the Fuller-Kinyon Pump, through a direct-connected air line.

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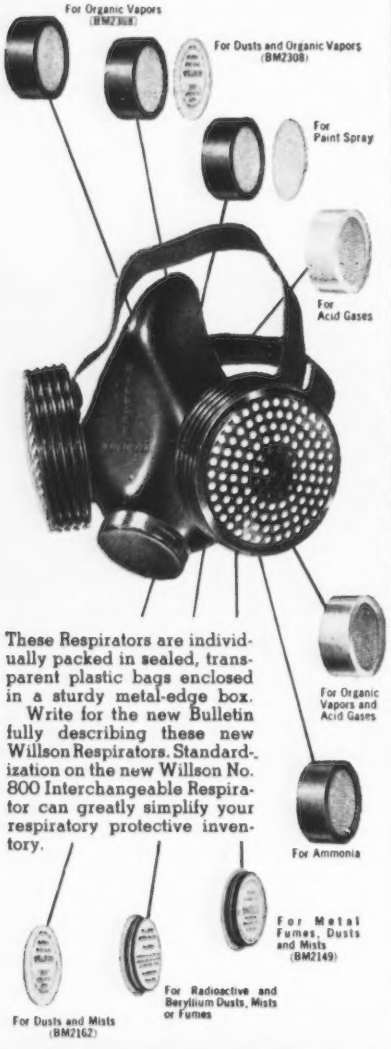

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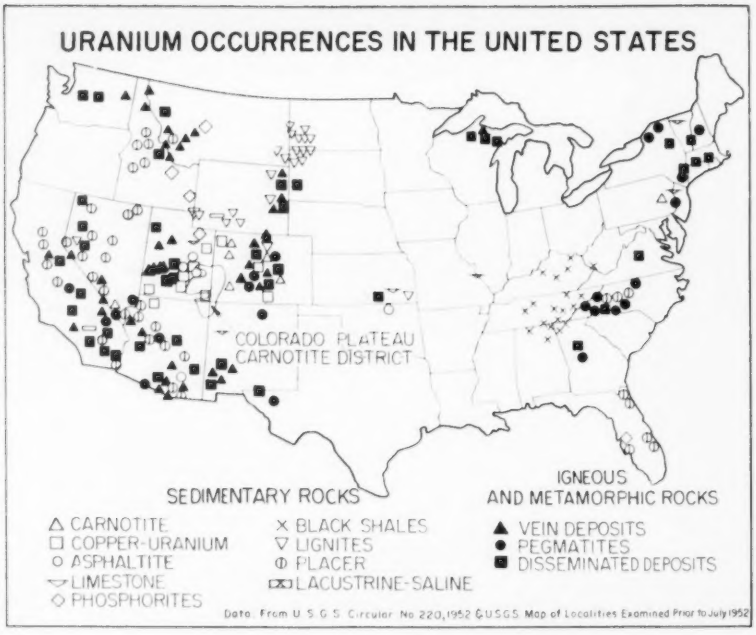

Sweden *(Continued)*

Sweden, in the first eight months of this year, the company has disclosed. This is only about half of the scheduled output for 1953.

In July, a record month, 976,000 tons were shipped in 96 vessels, but in August the amount fell to 620,000 tons in 60 ships. All the shipments were made through the Norwegian port of Narvik.

IN ASIA

JAPAN

★**Western Machinery Co.** of San Francisco has announced the licensing of the Sumitomo Machinery Co. of Niihama, Ehime Prefecture, to manufacture ore dressing mining machinery. A Western official explained that the arrangement is concerned largely with heavy media plants.

An agreement limits the license to manufacture and sale in Japan with the Western Co. reserving other Far Eastern areas for itself. Western also has done business in Indonesia, Thailand, Australia and the Philippines.

★**First iron ore** blending and reclaiming system ever to be built for the Far East steel industry has been shipped by Hewitt-Robins to Japan where it will become part of the new plant of the Kawasaki Steel Corp. at Chiba City.

The system, in use for a number of years in the United States, Great Britain, South Africa and South America, makes it possible to blend ores of different physical and chemical characteristics at a rate of about 300 tons an hour. Variations in ore grade are virtually eliminated and the mix which is fed into the blast furnaces makes pig iron of consistently high quality.

The equipment shipped to Japan includes a reversible reclaimer, traveling boom stacker with trailing trippers, transfer car, hopper cars, samplers and weightometers. Richard Kelly, Hewitt-Robins engineer, is being sent to Japan to supervise the installation of the system.

IN THE NEAR EAST

TURKEY

★**In Ankara**, the government announced that it has allocated $27-million to expand mineral production in government-operated installations.

Copper production, which in August stood at 23,000 tons, was expected to reach 26,000 tons by the end of 1953. This is compared to 1951 production of 14,000 tons.

Sulphur production is to be boosted to 15,000 tons in 1954 (past annual average: 7,000 tons), following the already planned expansion of flotation installations at production centers.

Iron production (220,000 tons in 1951) is expected to approach 350,000 tons this year. Completion of additional facilities now under construction at Karabuk and Divrigi is expected to result in a yield of about 450,000 tons.

IMPOSSIBLE WITHOUT EXPLOSIVES

During 1953, stripping operations will account for some 120 million tons of coal, or close to one-quarter of the total annual production. In extreme cases, deposits 150 feet or more below the earth's surface have been mined. For every five feet of coal thickness, an average of 39 feet of overburden first has to be removed. It's a job that never could be handled economically without explosives. Hercules has pioneered in developing the right types of explosives and has the service facilities to help solve any blasting problem concerning coal mining, metal mining, quarrying, construction, petroleum.

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New Books

Canadian Mines Handbook 1953. This annual publication is up to its usual high standard as a complete reference work and is divided in three parts, as follows: Part I—Principal Companies; Part II—Supplementary List, Including Inactive and Extinct Companies; Part III—Metal Mines Classified, Mining Stock Prices. Compiled, printed and published by Northern Miner Press, Ltd., 122 Richmond St. W., Toronto 1, Canada. Price $2.

The following, related publications may be obtained from Utah Geological and Mineralogical Survey, University of Utah, Salt Lake City, Utah. Prices as noted.

Geology and Ore Deposits of the Silver Reef (Harrisburg) Mining District, Washington County, Utah. Bulletin 44. By Dr. Paul Dean Proctor. Price $2.

Uranium-Vanadium Deposits of the Thompsons Area, Grand County, Utah, With Emphasis on the Origin of the Carnotite Ores. Bulletin 46. By Dr. Wm. Lee Stokes. Price $1.

The following publications may be obtained from The University of Texas, Bureau of Economic Geology, Austin 12, Texas. Prices as indicated.

The Geology of Henrys Chapel Quadrangle, Northeastern Cherokee County, Texas. University of Texas publication No. 5305. By H. B. Stenzel. Pp. 118 plus 57 text fig. and map in color. Price $3.50.

Correlation Between Surface and Subsurface Sections of the Ellenburger Group of Texas. Bureau of Economic Geology Report No. 11. By Leo Hendricks. Pp. 44 plus 1 fig, 6 plates. Price $2.50.

The Manufacture of Triple Superphosphate. By J. J. Porter and J. Frisken. Various aspects of the subject including history of manufacture, the chemical reaction between phosphoric acid and phosphate rock, general methods of manufacture, and a description of the operations at the new fertilizer works at Immingham, Eng. Published by The Dorr Company, Barry Place, Stamford, Conn.

Annual Report 1952. Published by the Department of Mines, Government Printer, Dar Es Salaam, Tanganyika. Pp. 60. Price 2s. 5d.

Report on the Mines Department for the Year 1951-52. Published by the Government Printing Dept., Accra, Gold Coast. Pp. 22. Price 2s. 6d.

Dezadeash Map-Area, Yukon Territory. By E. D. Kindle. Geological Survey of Canada Memoir 268. Published by the Canada Department of Mines and Technical Surveys, Ottawa, Canada. Pp. 68, plus map. Price 75¢.

The following publications may be obtained from Geological Survey, Government Printer, Perth, Western Australia.

Geological Maps of Portion of the Mt. Margaret Goldfield. By R. A. Hobson, K. R. Miles and R. S. Matheson. Bulletin 103, Supplementary Atlas No. 1.

Geological Maps of Mining Groups and Plans and Sections of Workings. By R. A. Hobson, K. R. Miles and R. S. Matheson. Bulletin 103, Supplementary Atlas No. 2.

The following publications may be obtained free from the U. S. Geological Survey, Washington 25, D. C.:

Circ. 267. Stratigraphy and Structure of Outcropping Pre-Selma Coastal Plain Beds of Fayette and Lamar Counties, Ala. By C. W. Drennen. Pp. 9 plus maps.

Circ. 237. Monazite Deposits of the Southeastern Atlantic States. A thorough report on monazite occurrence in a belt extending several hundred miles from Alabama to Virginia. Pp. 31 plus maps.

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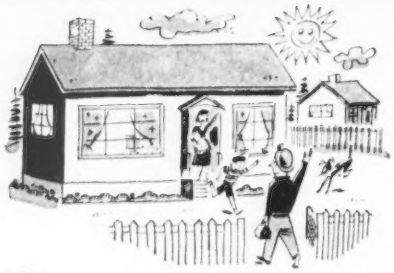

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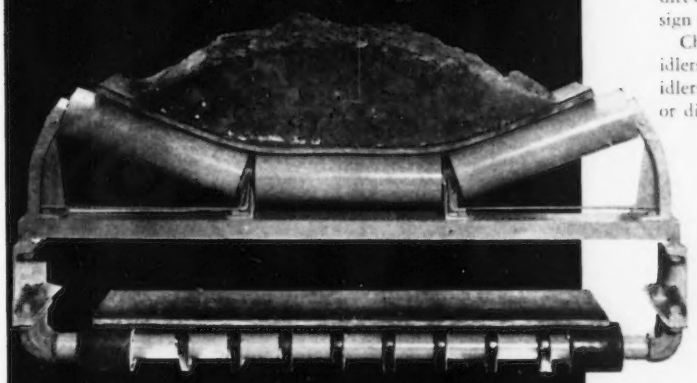

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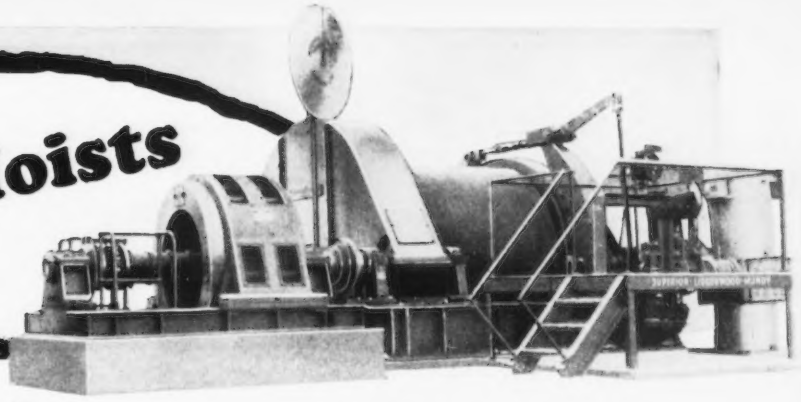

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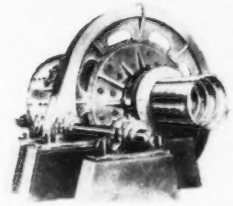

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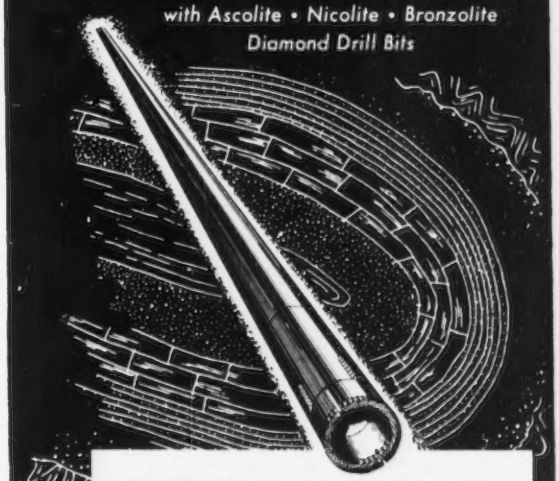

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(Continued on pages 216-219)

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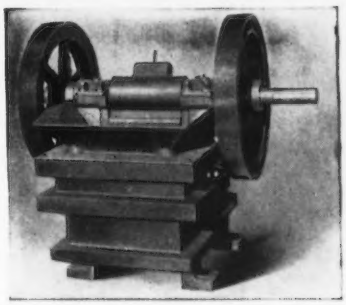

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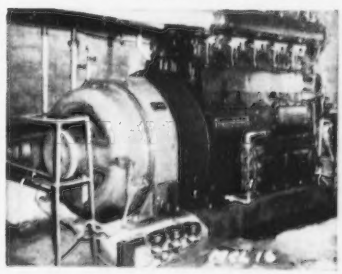
480 V. 3 ph, 60 cycle



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14"	4	1/16"	1/32"	28 Oz.
16"	4	1/8"	1/32"	28 Oz.
18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
30"	5	1/8"	1/16"	32 Oz.
30"	6	1/8"	1/16"	32 Oz.
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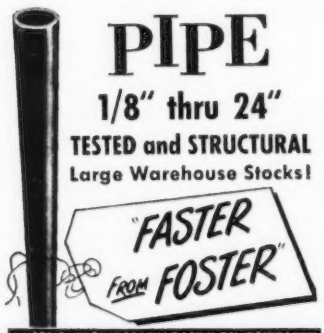

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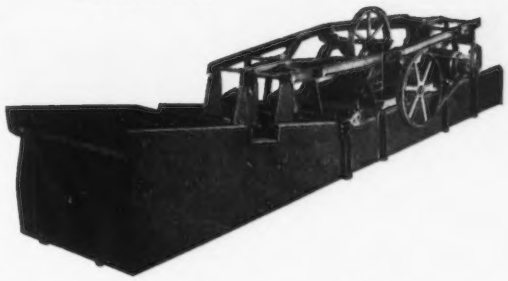

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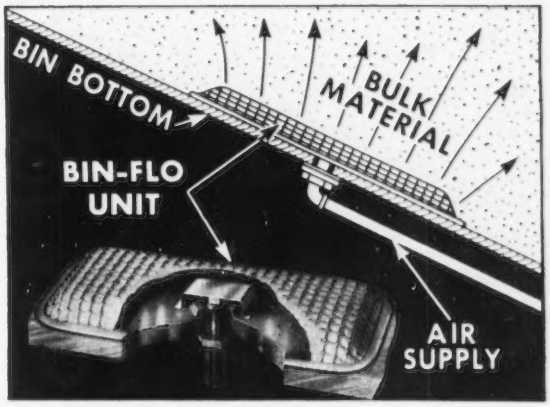

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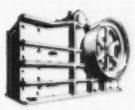

Jaw Crushers

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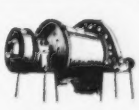

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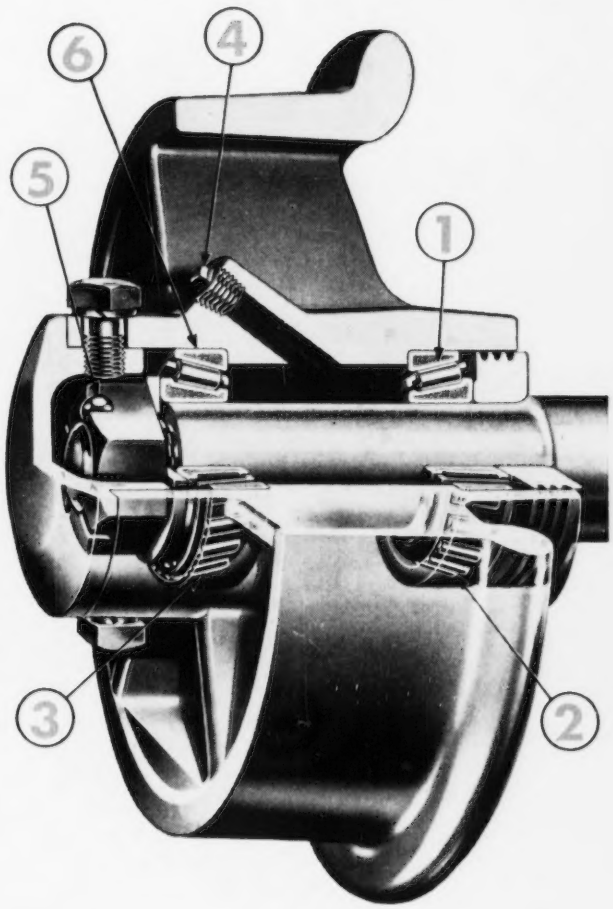

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